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SEPTEMBER, 1885.

THEO. S. CASE, M. D., WARREN WATSON, } EDITORS.

CONTENTS:

PAGE.

The Beginnings of Language 69
Early Stages in the Earth's Growth. DR. R. WOOD BROWN 77
Life in Death. WILLIAM CURRAN 82
A Chinese Columbus. W. W 88
Some of the Wonderful Productions of the Sea. MRS. G. HALL 96
The French Academy in its Origin 99
Bacteria 102
A Fish Eating Plant 105
Our Consular Service. HON. ARNOLD KREKEL 106
Weather Report for August, 1885. PROF. F. H. SNOW 108

EDITORIAL: The Dead Languages and Education—Science and Spiritism—The Spencer Harrisonl mbroglio, etc 111
CORRESPONDENCE: The Fatuity of Strikes—Phrenology Defended 113
SCIENTIFIC AND INDUSTRIAL NOTES: Apiculture—Ornithology—Astronomical Notes—Platinum—Japanese Technical Apparatus—Penetration of Light in Water—Commercial Value of the Eucalyptus Tree—Formation of Coal, etc 115
MISCELLANY: Romances of Mining—Great Games of Chess—A Whale Entangled in a Telegraph Cable—A Story of Two Rats—Song of the Ichthyosaurus, etc 126
CURRENT LITERATURE: New Books—Natural History—Microscopy—Philosophy, etc 133
Periodicals 136

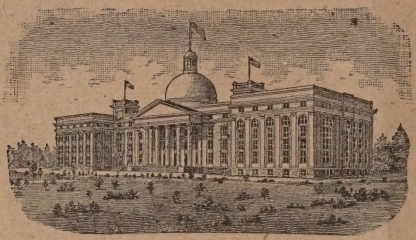
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UPON entering its ninth volume the REVIEW desires to call attention to the new features introduced by the present management and to register a promise to not only continue these features but to introduce such others as experience and a close study of the popular taste may dictate. The REVIEW will hereafter be a high-class magazine in every respect,—except subscription price. The October and succeeding issues will be illustrated, and no paper will find place in its pages except such as have sufficient merit to be admitted into the most pretentious magazine.

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SONG NOTES OF THE PERIODICAL CICADA. Prof. C. V. Riley (Read before the A. A. A. S. at Ann Arbor).

LIFE IN UNCONSCIOUSNESS. Frederick Hartman.

A CHINESE COLUMBUS (*concluded*) etc., etc.

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WORDS OF PRAISE

A considerable degree of pleasure was experienced a week or so ago when the REVIEW made its appearance in my mail. I had frequently expressed regret that its publication had been suspended—I feared it was a thing of the past. I enclose you a dollar to pay till New Year and hope it may *never die again*.

Yours etc., T. BERRY SMITH,
Professor of Chemistry, Pritchett Institute, Glasgow, Mo.

The KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY has been changed to the more simple and appropriate KANSAS CITY REVIEW, T. S. Case, M. D., and Warren Watson, editors. It is a live exponent of the scientific and industrial interests of the West.—*Iron Trade Review.*

The publication of the KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY has been resumed. The name has been abbreviated to the KANSAS CITY REVIEW, which is an improvement, as the former name was rather cumbersome. The first number of the new series, which is at hand, offers a very interesting, instructive and entertaining table of contents. The student, the scientist and the general reader will find much that is valuable in the contributions which make up the offerings of this number, which, we are informed, is but the forerunner of even better ones to follow. The names of Dr. Theo. S. Case and of Mr. Warren Watson as editors are a sufficient guarantee that the high standard of this magazine will be maintained. We commend it to all lovers of good literature and wish it unbounded success.—*Jefferson City Tribune.*

The September number of the KANSAS CITY REVIEW will be out this week. A glance at the well-filled pages of this off-spring of Western thought and enterprise must convince the most casual observer that it is decidedly the most entertaining number yet put to press. "The Beginnings of Language," "Early Stages of the Earth's Growth," "Death in Life," "A Chinese Columbus," "Wonderful Productions of the Ocean," "The French Academy," "A Fish Eating Plant," and "Our Consular Service," are among the most interesting of the articles. A meteorological report for August is given. The editorial department, unlike that in most magazines, is lively and spirited, each subject being handled in a fresh and attractive manner. Under head of "Scientific and Industrial notes," a whole volume of important and useful information is given. Those of the Sentinel readers who are not subscribers to this valuable periodical should become so, and while securing for themselves a valuable Western magazine, aid an enterprise that deserves their support.—*Independence Sentinel.*

We commend Col. Case for his determination to shorten the name of his instructive magazine to the KANSAS CITY REVIEW.—*Kansas City Times.*

THE KANSAS CITY REVIEW,

DEVOTED TO

Science, The Arts, Industry and Literature.

VOL. IX. SEPTEMBER, 1885. NO. 2.

THE BEGINNINGS OF LANGUAGE.*

The art of conveying conceptions, or impressions, from one consciousness to another, by vocal utterances, has its origin so far removed from the possibility of exact investigation that students cannot aspire to settle definitely the disputes that arise in every examination of the subject. From one point of view the genesis of spoken language was a miracle; and if this be the correct opinion there is little matter left for controversy, which would become, for the most part, mere logomachy. But if we examine the matter from a naturalistic standpoint many interesting questions and lines of research present themselves; and, as the discussion of the subject can be more easily approached on this side, it may be conceded, for the time, that vocal speech, like other arts, arose by slow, but progressive, steps from almost imperceptible beginnings. In fact this art is not confined to the human family. We know that many animals can convey by means of vocal sounds, well defined ideas which are recognized and responded to by their fellows. Who has not noticed the numerous modulations and inflections in the voice of a favorite dog? And who could fail to distinguish the bark of welcome from the bark of defiance? Brehm, the German traveler, says: "It cannot be denied that the voice * * * * of the Chimpanzee is a formal language. All the sounds are fully accentuated, and the observer soon understands the meaning of the different modulations, while children, playing with the animal, catch at once the sense of its utterances." Of course this observer did

*Read before the Query Club.

not mean that the language of the Chimpanzee is capable of syntax, or even of a vocabulary; yet it is a "formal language" in that it serves to express the animal's wants and moods. Even the cries of fowls and the larger domestic animals show their capacity to translate the rude concepts of the animal soul to other beasts and to man; while the researches of Sir John Lubbock establish the truth of Huber's statement that ants can converse by means of their antennæ.

But it must not be supposed that spoken language is instinctive in man or the lower animals. In truth even the songs of birds must be learned from contact with other birds, for, while the tendency to sing may exist, "the particular notes, or succession of notes," can only be acquired by imitation. The Tyrolese have taught their canary birds "a peculiar song and this they now transmit to their offspring." The bark of domestic dogs is an acquirement—wild dogs do not bark and by some it is supposed to be an attempt to imitate the human voice. Indeed it may be said that the progress of spoken language in animals is only limited by the form of the vocal apparatus and the functional development of the brain.

The relation between the cerebral centers and the mechanism of vocal speech is difficult to examine in its early stages. The infinitely complex arrangements of vocal chords, lips, teeth, palate, tongue and the multitude of muscles governing them, together with the management of the breath and facial expression, must be co-ordinated, through the cerebral activities; and it would be extremely interesting to trace out the history of the synchronous development of brain convolutions and the capacity to use vocal speech. But this department of enquiry is not yet in a condition to admit of any very useful observations. Suffice to say that an advance made on either side would tend to produce corresponding progress on the other. At any rate the recent experiments of Ferrier, and other vivisectionists, have shown that portions of the cerebral cortex bear a direct relation to speech; and that as one and another of these portions are removed, the power of vocal utterance is more and more limited, and finally destroyed. I might refer, also, to numerous cases of aphasia, accompanied by lesions in the cortical substance; but enough has been said to show that physiological development was an important factor in the beginnings of language.

Mr. Darwin has suggested that the first step in the formation of language might have been the imitation, by some anthropomorphous animal, of the "growl of a beast of prey" as a warning to his mates of the "nature of the expected danger." This suggestion is in line with what has been called the "bow-wow theory" of linguistic origins; a theory, however, which is growing in favor with scholars, notwithstanding the ridi-

cule it met at first from eminent philologists. According to the views entertained by this school, "language owes its origin to the imitation and modification of various natural sounds, the voices of other animals and man's instinctive cries, aided by signs and gestures." How from such low origins, the wonderful instrument of vocal speech arose to its present perfection and utility can be explained on the physiological ground above referred to and by the tendency toward change and novelty, which characterizes the human species, as well as by the ever increasing circle of acts, events, and things which civilization brings into relation with man. There is no question but that words were invented before connected speech, and that gestures, at first, formed an important element in the communication of emotions, wants, or impressions, from man to man. In fact, it would seem that gestures constituted the primeval verbs and adverbs, and that facial expression played a great part in limiting spoken words. Even now, though we have a "well of English undefiled," to draw from, we eke out our meaning by a thousand movements of the head, limbs, body and facial muscles, or, lacking that power, seem dull and cold to listeners. It is said that pantomime was carried to such perfection amongst the ancients that, not only farces and comedies, but even tragedies, were acted without a spoken word; and this art became so perfect in Rome that such dramas were presented to audiences drawn from all parts of the Empire, com posed of Romans, Greeks, Gauls, Germans, Persians, Parthians, Egyptians, Numidians and Jews, who could all follow the incidents of the plot with equal facility. It will be observed that gesture language does not take cognizance of verbal differences. It is obvious that the eye, the hand, the mouth, perform similar services for all races; hence a symbolism, drawn from such objects, and used to transmit ideas betweer different individuals, forms a universal language which is not concerned with the variations of spoken language. Yet, none the less, it will strongly impress a thoughtful student that spoken language must, *ex necessitate*, have been affected by gesture language very extensively, and must bear imbedded in its strata the fossils which, once discovered, would make the difficulties of the subject less insurmountable. Besides the learned and exhaustive work of Mr. Gatchett there are few books extant that can furnish any assistance to delvers in this field; but there is no doubt that the subject will continue to attract the curiosity of scholars till its difficulties are thoroughly explained.

It goes without saying that writing has nothing to do with the *formation* of language; though it has, undoubtedly, been instrumental in its modification and extension. Even the rudest savages possess a language of spoken words, however

meagre; and it must be borne in mind, before despising the trivial vocabularies of savages, that, even in this enlightened nation, there are few day laborers who can repeat three hundred words of their mother-tongue—a tongue which boasts a dictionary of one hundred and fourteen thousand words. "This fact," says Prof. Max Mueller, "simplifies immensely the problem of language." His view is fully borne out by recent researches. It has been discovered that every language is founded upon certain root words, few in number and hard to distinguish, on account of their great antiquity and the consequent changes in their pronunciation. Some of these roots, however, have an easily discernible origin. The names of animals are frequently derived from their cries; as cuckoo, bobolink, hoopoo, etc. Such words as bang, crack, purr, whiz, hum, etc., seem to be attempts to characterize the sounds they represent. Thus, also, of the inarticulate sounds of the human voice; such as those expressed by the terms moan, groan, sigh, cough, sneeze, yawn, halloo, etc.; those of animals simulated by cackle, gobble, twitter, mew, yelp, roar, croak, etc.; words expressing the collision of hard bodies, rap, tap, snap, slap, crack, smack, whack, pat, batter, beat, etc.; the sense impressions expressed by clash, smash, crash, splash, clang, ring, bump, thump, boom, hum, hiss, rustle, whistle, whisper, murmur, whir, puff, fly, flit, flow, flutter, patter, crackle, bubble, rush, etc. From characteristic, but inarticulate expressions of the emotions we get a number of words like woe, ache, etc.; from O! Ah! Ugly, hugh, huffy, from the guttural ugh! etc., etc. It is true such words form but a small part of the vocabulary of a language and, admitting that in-so-far as we detect such probabilities of origin we can trace a word to its original root, yet there are large classes of ideas which are seemingly not expressible by sounds either directly or by analogy. But even here the difficulties are not insuperable. Take the word "heart," for instance, whose etymology discloses that it is the descendant of a root word "hrad," which attempted to reproduce the throbbing sound of the heart-beat; and "foot," from the root "pad," evidently an attempt to give the sound of a foot-fall; and "daughter," from the root "dhugh," to milk, (the milker) probably onomatopoetic for the sound made by the gushing milk in the pail. These are mere guesses of course, and it is quite likely they are incorrect, but the point can be illustrated by them just as well as if they were entirely apposite. Suppose the primitive man wished to describe some carnivorous animal; the most salient characteristic to him would be the savage growl, and this, imitated, might become the name of the beast. But the matter would not end there. From this newly coined substantive adjectives, adverbs and verbs would

be formed *ad libitum*. Our noun "dog" has given us, as an example, the adjectives "dogged" and "doggedness," the adverb, "doggedly" and the verb "to dog"—all of them far removed from the root-word, which, probably, was merely an attempt to reproduce the snarl of the animal named.

Many such examples could be given but, in the end, they would only emphasize the point without strengthening it.

These instances give rise, however, to another reflection. It is apparent from them that the real thing apprehended by the primitive man most clearly was the qualities or characteristics of surrounding objects. It is this fact which accounts for the universality and homogeneity of sign language before alluded to, and may account for the striking similarity of occasional words among widely scattered nations. The sound of the wind among the trees, the patter of rain-drops, the surge of ocean billows, the ripple of flowing water as well as the cries of birds and animals, would be phonetically similar whether reproduced by the human voice in China or Peru. The deduction is too obvious to dwell upon.

It has been contended that the steps by which an infant advances to a knowledge of language, reproduce the stages which, respectively, presented themselves to primitive man. This contention is correct in one sense at least, for whatever might have been the actual process, there is little doubt that the language of each race furnishes many evidences of a growth from the simple to the complex. An infant, in its first instinctive efforts to use its voice, gives utterance to a meaningless gabble which cannot be considered as even incipient speech. It is not an attempt to express its wants and bears no more resemblance to language than the sound of the wind in an Æolian harp does to true music. Both come from the insensate side of nature. But there is a difference between them. The wind might breathe upon the strings of the harp forever without producing any thing better than the wild chords its first zephyr had aroused; while the intelligence of the child observing the effect of the sounds automatically produced by its vocal apparatus, would strive to reproduce them consciously and would thus form the nebulæ of language. The intellect of an infant, like that of the lower races of man, though in an embryonic state, is quick to respond to outside impressions. When the discovery is made that its utterances are responded to by certain familiar objects which are always in its vicinity, the child begins to associate these objects with the sounds it makes. For instance, one of the first sounds the voice of a child produces is *ba* or *pa*, *da* or *ta* or *ma*, and the result is, that among widely separated people in Africa, Asia, Europe, North and South America, Australia, New Zealand, and the islands of the Pacific, the pa-

rental relations are expressed by the above sounds or their modifications or duplications. These primeval germs of language, seemingly so insignificant are really of vast importance, for it is the first steps always which are the most difficult. Having discovered the efficacy of nomenclature the infantile mind is not slow to extend its vocabulary. The record kept by Taine of the linguistic progress of a child is a curious confirmation of this fact.

It is thus that an infant in its first instinctive efforts at vocal speech gives names to its parents and attendants and the objects of its wants. Along with these substantive words would come ideas of quality, of attributes which characterize these various objects. Food is good or bad, nurse is cross or kind, medicine is nasty, etc. Thus it is that the child next gathers a small list of adjectives to help out the few substantives and pronominals at command. Then there enters its dim consciousness another, and a very important impression; that is, that these objects, so named, exist independently of itself and are capable of performing certain actions. This step in mental progress furnishes it with pseud-conceptions which need characterization, verbal identification. This, with the prior experience of the child, is easily accomplished and he is now in possession of the skeleton of language. The next step is to put it together. To do this properly there are other kinds of words to be acquired—viz: prepositions, adverbs, conjunctions, etc. These are not such easy conquests as the others, because, standing by themselves, they have no meaning whatever, and the child can only grasp their office by observing their relation to other words. It is true a sentence can be constructed without these meaningless words: "dog runs," or "black dog runs," are sentences which convey well defined ideas, and both could be easily constructed by the child. But the sentence "black dog runs fast and barks fiercely," is too complex, contains too many meaningless words, to be so readily apprehended or reproduced; yet adverbs are very easily acquired in comparison with prepositions. Indeed many fairly educated men make frequent mistakes in the use of these vexatious little words which are so utterly barren of meaning in themselves, and yet are so potent in fixing the meaning of other words.

That by some such gradational development a child acquires the art of vocal speech will not be questioned: and there is little doubt that primitive man acquired his stock of words and put them together in much the same way.

There is this difference, however, to be noted: the words which the child learns are, for the most part, taught to it by rote; while primitive man was forced to coin the words out of which his sentences were constructed. How, then, did these

meaningless words first come into existence?

In carrying out the linguistic development of a child we have outrun the development of primitive speech. We have talked of substantives, pronouns, verbs, etc., while in truth there is every reason to believe that in the earliest language each word might fill the office of the various parts of speech interchangeably. In the Chinese language such is the case even now, and it is true also of several other languages. In this stage of development all the words of a language must have had well defined meanings, and only became prepositions, adverbs, etc., from the relation in which they stood to other words. This is not all speculation. We have traces even in so old a speech as our own of the growth of meaningless from significative words. Thus our preposition "from," originated in a primitive Aryan verb, meaning, "to go through," or cross, while the conjunction "and," came to us as an int. verb, (and was used as such by Shakespeare,) and "the" came into our speech as a relative pronoun—in fact the pronoun for all genders which we now lack, and need so much. Many instances of this kind could be adduced; but by far the larger part of the meaningless words in our language baffle the acutest enquiry into their origin. From the few known derivations, however, we are enabled to guess the mode in which many words of this kind originated.

It is stated above that language has been traced back to comparatively few root-forms; and when we are told further that these root forms are all monosyllabic we can see that the primitive speech of man was composed of words of one syllable like the language of the Chinese and of the Otomi of Mexico. The process of building up polysyllabic words came about by agglutination, which is characteristic of all rude languages. In fact it was this process of agglutination, together with certain vowel changes, which produced the earliest inflections of substantives and verbs. The root-form was usually a consonantal sound or a combination of consonantal sounds. A vowel breathing was given to this, and different shades of meaning were expressed by changes in this breathing.

It was by some such process as above pointed out that man first equipped himself with those sounds which formed the fixed roots of words expressing objects, conditions, qualities, actions, and derived from them the elaborate material of cultivated speech. Many of such derivatives are the meaningless words before alluded to, which perform such an important office in determining the relation of other words, and which appear in our inflectional forms in an atrophied state; and these inflectional forms now invite our enquiry as to their origin and growth.

It is obvious that the essential idea in the substantive is the object nam-

ed; in the verb the action verbally characterized. But primitive man would soon find the bare root-words too inelastic to serve his purpose. The relation of different objects to each other, the different modes and successions of action and the varying persons of the actors, would demand recognition and verbal discrimination. If all these different shades of meaning had required the invention of distinct words to express them, language would have become too cumbrous an instrument for the every day uses of man; and there was no tendency in this direction. The natural process of evolution, while it advances from the simple to the complex, does not create or destroy; it simply differentiates and combines. Language was no exception to this law. When the earliest man perceived an object or an event in novel relations, he did not coin a new word to express the phenomena, but took the word already known and added to it the words expressive of the relation. For instance, the phrase "beside the tree" expresses a complex idea in which the element "tree" is subordinate to something which is pointed out by its vicinity. We place the inflectional word before the noun, but the natural way, as shown by the comparison of all languages, is to make it come after the word to be affected. Thus our primitive friend would say "tree beside;" using, however, instead of our preposition, words which to him gave a notion of the relation he wished to express, and which gradually assumed the prepositional form only to lose it again in a case ending. "Beside," for example, is composed of an archaic word "be," meaning *round*, and "side," which originally meant the *edge* or *border* of a thing. Thus "tree beside" would have, at first, a meaning in all its components as above stated.

This is indubitably the mode in which our inflections originated; and the rise of this feature in linguistic growth heralded the approach of the grammar stage of language. It is apparent that so long as speech remains monosyllabic, that is so long as every compound word can be split up into other words, each with a distinct office, rules of grammar are of no utility whatever. But a time comes finally when neither the root or its added elements have distinct meanings; when all of them, taken together as one word, are indispensable to perform the required function. It is at this time that grammatical science becomes necessary and possible. Most all languages are in this condition of growth, at least in the Indo-Germanic, or Aryan family. For, while we have been dissecting modern words to find their atrophied components, it must be borne in mind that much of this is guess work; and it is only the refinement of philology which distinguishes the separate words of the ancient expression among the debris that remains after centuries of use and decay.

We have now reached a position which is properly the last stage in the growth of language; but there is a final principle which calls for a few remarks. After speech has attained the inflectional form a peculiar change tends to come about. To illustrate, take the verb "to be." The earliest form of the *p. t.*, *ind.*, *1st pers.*, is the sanscrit *asmi;* and the consonantal sound—*m*—in that verb, whatever primitive word it may represent, is perceptible in our "am." In the sanscrit word, *as* is the verb, while *mi* is merely a relative pronoun; and thus our verb, singularly enough, has eliminated all phonic fragments of the original verb and retains a single sound only of the pronoun. It follows that when we say "I am," we are simply uttering, according to original meanings, "I, I."

It is hardly necessary to remark that almost all of the stages of growth in primitive languages still occur, even in our finished form of speech, for large bodies of words. And we can easily study their development by condescending to notice the changes, by way of idiom, slang, foreign words, corruptions and provincialisms, which daily occur in colloquial speech. But enough has been said to serve the purpose for which this paper was prepared.

EARLY STAGES IN THE EARTH'S GROWTH.

There are many things in the scientific world that are interesting objects of study and subjects for thought. The most important discoveries in science are known to every well informed person. Many of these discoveries are known like house-hold words. The scientist with his instruments, the merchant in his library, the minister from the pulpit, the farmer at his table, and the woodsman at his cabin door, all discuss momentous subjects, and each astonishes his hearers in the same ratio as their ignorance. The cracker-barrel of the corner grocery is not without its oracle, who settles the questions of Science and Theology before a gaping audience.

Objects of which we are conversant never lose their interest; no matter how many times they are presented before us there are always new points to study, whether it be a trilobite or a horse-shoe crab, a mastodon or the armadillo. We, as students, never tire of old, and are ever anxious to learn new, truths. The geologist's hammer rings just as cheerily as ever, the palæontologist is never weary, and the physicist is persistently trying to forge the one single link which will make his chain complete.

The moon being the nearest orb, (221,590 miles from the earth) let us visit it mentally, and from its surface watch the formation of the earth

from its nebulous mass. The *nebular hypothesis* is known to all, and those of us who accept the theory do so owing to its plausibility. Nebulæ is a name that was given to indistinct patches of light in the starry fields. It has been shown that some of these are (1) clusters of stars, or (2) masses of luminous gas or vapor, thereby vindicating Herschel and Laplace.

We are now looking from our eyrie in the moon, upon a mass of gaseous or vaporous nebulæ. This gradually becomes smaller and denser, loses some of its luminosity and begins to borrow splendor from surrounding celestial bodies, assumes a globular form many thousand times larger than the present size of the earth, forms a nucleus of solid matter enveloped by a dark curtain of clouds and chemical vapors. Circumstances prevent our physical gaze from penetrating beneath this curtain, but mentality comes to our aid and we part the clouds, thereby enabling us to see a molten substance which we will call granite. We observe that the clouds, constantly whirled about by tempests, precipitate a primeval rain upon the liquid granite only to be thrown back in masses of vapor. This produces other meteorological disturbances. Storm after storm sweeps across the sphere, tornadoes, cyclones, simoons and hurricanes are striving for mastery over the new born earth, and, neither one gaining supremacy, they all maintain control of some portions of the earth during its life. Every torrent of rain upon the granite, as we can see, chills and disintegrates until it is sufficiently cool to retain metals, and other mineral substances and at length a certain amount of water; thus we have oceans, lakes and rivers composed of the element necessary for sustaining the first life.

In this nebulous mass surrounding our infant world are the elements to produce and maintain life. In it is the germ of wheat, the protoplasm of animal life, the bioplasm of man. This nebulous material contains the dreaded fire-damp and the invigorating oxygen. Within this luminous vapor are the elements which millions of years hence will produce crime and benevolence, sorrow and joy, gentleness, anger, bitterness and sweetness; in fact every potency which supports or destroys life, or makes, or mars man's destiny, is contained in this nebulous mass. We now notice through a rift in the clouds that the waters are rushing along, and torrents of rain are falling, both producing erosion of the igneous rocks. The unequal cooling, denudation and internal disturbances have formed hills, vales and mountains. By the heat of the scarcely cooled surface, coupled with the sun's rays, water is drawn into clouds and precipitated again and again in tempestuous masses, cutting, tearing and washing the primeval rock which is carried along to be deposited in whirlpools and ponds and lagoons, thus making the

first stratified rock, called Laurentian in North America, and Pre-Cambrian in Europe. The waters are now less turbulent, and, if we could make an examination, by the aid of a powerful magnifier, animalculæ could be seen, composed of minute calcareous shells chambered or not, containing gelatinous matter. The waters are teeming with *foraminfera* which are termed eozoon. These animals constitute the first life of our world. The waters need not necessarily be cool, for some of the lowest orders of infusorial life can live in warm waters. If extreme evolutionists are correct all future life of the earth sprung from these eozoon, or we might say vitalized mud. These animals, upon their death, would precipitate their shells, thereby making limestone. All the limestone of the earth is made from the shells of animals. The eozoon were so numerous as to produce Laurentian limestone 20,000 feet thick. Lead, copper, baryta, graphite and mica make their appearance in this the second period.

The clouds are drifting lazily away from our field of vision, and we can see the evolution of the third period. The earth is rapidly cooling, the terrestrial disturbances are lessening, storms are more regular, order is taking place of chaos. This we will designate as the Huronian in North America, and the Cambrian in Europe. Lagoons, lakes, rivers and ponds are frequent. The earth is no longer rent with gigantic volcanoes and terrific earthquakes. In the waters swim annelids, or worms, and the beautiful trilobite crawls over the mud of lagoons around lake Huron. The trilobites feed upon worms, and if we could see them closely, it would be noticed that their eyes are novel in construction, like unto no other animal. The eye is raised above the body in the form of a frustrum of a cone, open upon the side nearest to the same condition of the other eye. This cone is composed of facets the same as that of the common house-fly (which has about 4,000 facets or eyes.) This fact teaches us that the phenomena of light and vision are the same now as they will be when man appears, also that our Silurian waters are sufficiently clear to transmit light. As companions to the lobster-like trilobite with its three lobes, we notice mollusks or shell fish and the industrious coral insect, fabricating its chain coral which will not be found in any period except the Silurian now forming. The one inch trilobite of the upper Cambrian has now attained a length of twenty inches; four hundred species flourish in our Silurian waters. In the upper Silurian we see a companion for the trilobite. It is darting hither and yon; it glistens in the sun-light; it is the first fish; we will call it *placoid*, from its irregular plates with spines, a low order of animal with a fierce nature. The earth is now cool upon its surface. As fish cannot live in hot water the earth's surface must have become measurably cool at this

time. The climate is milder, storms are periodical, the flowing waters are muddy, the winds are blowing sand and pulverized rock in all directions. Mollusks, or clams, snails and cuttle-fish, trilobites and fishes, are dying; their bodies are thrown upon the shore, and in a dessicated state are blown to mix with the sand and pulverized rock, thus laying the foundation for soil for producing vegetation; even now we can notice seaweeds, and on the shore where the mud is the richest are the first land plants. These plants will indicate hereafter a new formation called the old red sandstone. We cannot see many aquatic animals near the shores, owing to the red oxide of iron in the water, that gives color to the old red sandstone, which, like all other rocks, except granitic and volcanic, is formed by sediments precipitated from the water. The luxuriant vegetation, just commencing, shows a great amount of carbonic-acid gas in the atmosphere. The flora is now increasing; it is spreading over all dry land; the waters are wearing away the rock to make new formations; snails and clams are making the deposits rich with fauna; and the octopus, or cuttle-fish, is searching for prey. Step by step the earth is being prepared for higher forms of life.

We can see through open clouds the formation of the Devonian period; and, as the earth rolls so as to show the American continent, we will see terrestrial plants, the first step towards terrestrial life. Snails, trilobites and clams are continuing to flourish, and by living and dying, assist to make new strata that are rich in fauna. Although this is the age of fishes, land plants are numerous, ferns, *Lycopodia*, or ground pines, four or five feet high, jointed rushes, Calamites, or tree rushes, twenty to eighty feet in height, and many flowering plants; all producing a flora of one hundred and eighteen species. We also see the first American fish, called the Ganoid, from being covered with bony plates, sometimes entirely encased. The character of these indicates a struggle for existence in the seas, while on land everything is comparatively peaceful.

Where land, water, rocks, seaweed and a few trees were to be seen, we now notice that a luxuriant vegetation is springing up. Vast tropical forests appear, not only at the equator but far north. Most of the whole dry surface is covered with ferns, bushy shrubs, tall coniferous trees as well as those bearing nuts. As carbonic acid gas is to the plant what oxygen is to the animal, we know that the atmosphere around the earth is surcharged with carbonic acid gas. The vegetation flourishes and takes from the atmosphere what would prevent animals from living. This is another step towards preparing the earth for the highest type of life, another product from the nebulous matter. We are now witnessing the formation of coal measures, or the carboniferous period.

Immense rhizodonts, or crocodiles, make their appearance for the first time; they feed upon fish and crustacea. The American nautilus is crawling laboriously, spiders, scorpions and land snails are creeping about, and the crab wades around, and over, beds of clams. While the struggle for existence is just commencing, let us notice the formation of coal. There we see luxuriant vegetation, yonder an impenetrable forest, consisting of *stimaria* pithy without branches, reed-like plants; *lycopods*, or fern-like mosses; *arancariles*, or pines, fifty feet high; in fact we can count five hundred species of plants which produce an arborescent vegetation like unto which we shall never see again. Dense clouds obscure our vision, and while they are clearing up let us indulge in speculation as to the manner of coal formation, which may be in one of three ways: (1) Upheaval by internal disturbances, throwing down the flora, which is covered with sediment and earth, and carbonized by time. (2) In the forests are large bodies of water. Upon these inland seas twigs, leaves, and decomposed trees fall and undergo disintegration, thereby producing an oleaginous substance. Under intense sun-rays this substance loses its volatile matter, leaving a thick, dark, gummy mass; additions are made to it, until it sinks to the bottom, carrying with it perfect wood, leaves and ferns. The whole is covered with sediment which in time becomes a layer of rock. This process is continued until the coal seams are completed. (3) The vegetation grows upon clay. Roots permeate the clay, mingling with shells and marine remains, and this compost is gradually submerged until the foliage is under the water, and from the want of proper nourishment dies. Another layer of clay is formed over the sunken vegetation, upon which grows a new foliage for another coal seam, and so on until the 2,000 feet, or more, of the coal measures are completed. As the cloud passes from between us and the earth, and the atmosphere clears a little, it seems as if the last mode of coal formation is the right one, yet we cannot be positive. We have seen enough to show that vast forests cover the earth—that is the northern part of it—the southern is still under water.

As all mists and clouds pass away, we know we are still viewing the coal measures, the beginning of the paradise of the palæontologists, the elysian fields of the evolutionists. With a piercing eye we can see the first reptiles; the fishes which we have seen so long still flourish, but the trilobites have disappeared. The lagoons and small lakes containing them we have seen filled up, burying their bodies, which the geologist's hammer, ages hence, will unearth to the delight of the fossil hunter. The placoid fish has left its spines, cranial bones and plates in mud, secure for study millions of years from now. The cuttle-fish, clams and snails still

add interest to the carboniferous waters. The arborescent vegetation has absorbed the superfluous carbonic acid gas, leaving nitrogen and oxygin for terrestrial respiration. Land is rising and waters subsiding. Limestone, shale, clay, sandstones and slates have been formed by deposits from water; these by grinding and erosion have again become sediment, which being mixed with dead mollusks, trilobites, fishes and vegetable matter, compose a soil capable of producing food for a higher order of life. Ere long the bird-songs will welcome, with music and brilliant plumage, the mammals, and a new era of the earth's existence.

A dense cloud passes between the earth and our position upon the moon, and so ends the palæozoic, or primary stage of the earth. Intervening clouds have caused us to miss many an interesting stage of growth; yet we have certainly learned some things by studying the earth's growth from infancy, with its swaddling clothes of nebulous matter, to its second period of existence.

LIFE IN DEATH.

[From Knowledge.]

No one can have read extensively in any species of literature without coming across passages or occurrences which must, at first sight, at least, appear to him to be incredible, if not absolutely impossible. Nor is this experience peculiar to works of fiction, in which it would, of course, be more excusable than elsewhere; it obtains also in the graver productions of the literary pen, and exaggeration, instead of diminution is the characteristic of the genus *irritabile vatum* everywhere. Passing by, therefore, as being in a measure privileged, the "words that breathe, and the thoughts that burn" of the poet, we will descend into the lower plain of the historian, and endeavor to show that, so far as certain *escaper* or occurrences narrated by the latter are concerned, "truth is sometimes stranger than fiction."

Without stopping to discuss the differences that are produced in wounds inflicted by modern weapons and those that are due to the appliances used in former times, we may glance at the constitutional capacities for endurance, etc., that peculiarities of soil, climate and food impress upon certain races, and so avoid technicalities of all kinds. It is well known that man in the savage or semi-civilized condition has those organs of sight, hearing, touch and the like, with which he has to contend for his support with the beasts that perish, more highly or sensitively developed than his brother of the city or the plains; and as an illustration of this, we may point to the fact, no-

ticed in all the papers, that the Maories who lately visited this country always saw land before any of their fellow passengers. The savage man, *pur sang*, can sustain with impunity an amount of exposure and suffering that would certainly prove fatal to his more civilized brother, and the insensibility with which the American Indians, for instance, endure initiatory and other tribal tortures is simply astounding. A similar measure of imperturbable indifference to pain, and even death, has been noticed in Oriental countries, and all our doctors in India testify to the rapidity and sang-froid with which their patients in that country bear and recover from the effects of grave surgical operations, and other like injuries. But this phase of the question is generally acknowledged; so that we need not dwell further upon it here, and one has only to examine the calf muscles of the *danseuse* or horse jockey, or the biceps of the blacksmith, to find that some of their muscles, as well, perhaps, as of their faculties, are developed at the expense of others.

That doughty deeds of personal daring and adventure were thought more of in the past than they are at present, may be at once admitted, and those hand-to-hand encounters we hear so much of in the pages of Gibbon and other writers are now rarely witnessed. Krupp guns and Martini-Henry rifles have so entirely revolutionized the art of war as to throw mere physical strength into the back ground, and place men, in the aggregate, on a level. Moreover, the atmosphere of the East has never been favourable to the enunciation of truth for the truth's sake, and it was the interest as well as the desire of the crusading writers to exaggerate the performances of their leaders and masters.

Nor need we go back to the crusades for examples in point. They are to be found much nearer home, and deeds are ascribed, by serious writers, to some of our heroes in the East which would do no discredit to the prowess of a Cœur-de-Lion or even a Saladin. Thus, describing some of the hand-to-hand encounters that took place at Meeanee, Sir Charles Napier is represented by his brother as saying ("The conquest of Scinde," Part II., p. 320) that "Fitzgerald's sword on its descent went shear through shield and turban and skull, down to the teeth," and Captain Creichton is said to have assured Swift (Works, Nimmo's Ed., p. 531) that "Fowler (a covenanter) aimed a blow at me, but I warded it off, and with a back stroke cut the upper part of his skull clean off from the nose upward." Dean Millman caps this narrative with an account he gives of the strength and skill of one Ali, who, it appears ("The History of the Jews," Vol. II., p. 96), "Clove the skull of Marhab, the great champion of the Jews (of Khaibor), through his buckler, two turbans, and a diamond which he wore in his helmet, till the sword stuck between his

jaws," and whether the weapons used on these occasions were of Damascus or Toledo manufacture, we are unable to say. All we know is, that no such results follow from sabre blows or cuts in these, our degenerate days.

So keen is the instinct of self preservation, or the love of revenge, that men—aye, and women too—have been known to achieve results under their influence which they would scarcely think of at any other time, or under any other impulse; and it is well-known that the excitement of battle and the hope of conquest have often enabled a handful of men to hold their own against overwhelming odds, and induced individuals amongst them to undertake enterprises that would in any other situation appear impossible. It is doubtless, to these feelings that we owe some of the displays noted within; and the greater strength and ferocity of mountaineers is universally acknowledged. The two following stories will enforce and illustrate these points:—

Describing an encounter that took place in the reign of Robert III., between a body of Highlanders and a party of Lowlanders, Mr. Tytler says ("The History of Scotland," Vol. I., pp. 93-4), that "Lindsay had pinned one of these mountaineers, a brawny and powerful man, to the earth; but although mortally wounded, and in the agonies of death, he writhed himself up by main strength, and with the weapon in his body, struck Lindsay a desperate blow with his sword, which cut him through the stirrup and steel-boot into the bone, after which his assailant instantly sunk down and expired." And General Napier mentions a very similar struggle between a soldier of the 22d Regiment and a Belooche swordsman. His account of it runs as follows (*ut supra*, Part I., p. 317): "A soldier, bounding forward, drove his bayonet into the breast of a Belooch. Instead of falling, however, the rugged warrior cast away his shield, and seizing the musket with his left hand, writhed his body forward on the bayonet, until he could avenge himself with one sweep of his sword." He adds that "a Belooch requires no second stroke," and that "both fell dead together." Very tragic, no doubt, but—farther deponent saith not.

We may quote the following from Scott, without in any way vouching for its probability in connection with this kind of mountain warfare, and leave the narrative to speak for itself. Describing the fierce and fatal struggle that took place in 1652 between Evan Cameron, of Lochiel, and an English officer of great strength, Sir Walter says ("Tales of a Grandfather," 1872, pp. 501-2) that "he (Lochiel) had a personal rencontre strongly characteristic of the ferocity of the times." Being singled out by the officer referred to, and as they were separated from the general strife, they fought in single combat for some time. Lochiel was dexterous enough to disarm the Englishman; but his gigantic adversary suddenly closed

on him, and in the struggle both fell to the ground, the officer uppermost. He was in the act of grasping at his sword * * * * and was naturally extending his neck * * * * when the highland chief, making a desperate effort, grasped his enemy by the collar, and snatching with his teeth at the bare and outstretched throat, he seized it as a wild cat might have done, and kept his hold so fast as to tear out the wind-pipe. The officer died in this singular manner. Lochiel was so far from disowning or being ashamed of this mode of defence that he was afterwards heard to say "it was the sweetest morsel he ever tasted."

Let us now turn to another phase of the question, and see how far that deviates from credibility, or accords with the experience of our common life. Dwelling, apparently with much complacency, on what he called the *Horendus Maximini interritus—alias* the painful death of the tyrant Maximinus—Lactantius says (*De Mortibus Persecutorum*):—"*Deinde post multus gravesque cruciatus, cum caput suum parietibus infligeret, exilierunt oculi ejus de caveis;*" and it is worth while asking whether anyone, sane or otherwise, can *per se* "dash out his own brains," or cause his own eyes to start or jump out of their sockets. Grave writers and "able editors," as Carlyle would call them, say the thing is possible, and we occasionally read of such performances in connection with police-cells, lunatic asylums, and the like. Thus the reverend author of a little book called "A Popular History of the Insurrection of 1798," after mentioning the dreadful sufferings that were endured by those who were subjected to the horrors of half hanging and the pitch cap in that year, says (p. 72,) that the victims of these pleasantries "dashed their brains out, in the madness of intolerable pain, against some neighboring wall, and thus put an end at once to their life and misery;" and the following occurs in Mr. O'Hagan's translation of the song of Rowland:"—

> He (R) saw the Saracen seize his sword,
> His eyes he ope'd and he spoke one word—
> * * * * * * * * * *
> On the golden crest he smote him full,
> Shattering steel and bone and skull;
> FORTH FROM HIS HEAD HIS EYES HE BEAT,
> And cast him lifeless before his feet.

where we may safely leave him for the present.

If now, making every allowance for the poetic license assumed above, as well as for the juxtaposition of bone and skull, as if they were not here as elsewhere identical, we come to the beating out of the eyes and the dashing out of the brains, and ask ourselves if such things ever can or ever do happen, our answer will be that they probably never do. And yet stranger occurrences than even these have been gravely recorded by eminent historians. As an instance in point, we will quote the following from Milman. Mentioning the hard usage according to which the Syndic of the Jews was obliged to salute the mayor of Toulouse about the year 980, he says (*ut supra*, vol. ii., p.

146) that: "A stern, iron-handed magistrate struck the poor Syndic with such force as to scatter the brains of the unfortunate unbeliever" —and the hand that achieved this feat must, indeed, have been made of iron or other equally potent material; for unless this wretched Syndic was suffering from that very rare condition called *Mollities Ossium*, or that our magistrate had the strength of a Hercules, it is hard to conceive how such a result could follow from such a cause. And yet there is no affectation of poetic license or unreality here—the possibility of the thing is taken for granted, and there is no qualification such as even a query or note of admiration could supply. All we need, therefore, say in this connection here, is that where grave and learned writers like Milman put forward such statements without question, we ought not to be surprised when we find Scott and other romancists of his class investing their heroes with such attributes as are clearly beyond the reach of ordinary mortals.

It is, we believe, generally admitted that negroes have sometimes succeeded in committing suicide by swallowing their tongues; in other words, by doubling them back, and then drawing them into their throat, so as to stop the access of air to the lungs; and excision of the tongue is now a recognized surgical operation. But this operation to be successful or effective must be performed by a skilled surgeon or a trained executioner, and persons desirous of shuffling off the mortal coil never dream of trying to do so through the medium of this organ.

We have it, however, on the authority of Major Macpherson ("Memorials of Service in India," p. 67) that, "a Khond, captured by our troops in Baramootah, immediately tore out his tongue by the roots and died," probably of the hemorrhage which such attempt would necessarily entail. But it does not seem possible for anyone to tear out his own tongue with his own unaided hands, and in proof of this we have only to ask our readers to try and seize that somewhat slippery muscle themselves. If they will try they will probably find that they cannot introduce the hand into the mouth without producing sensations that would prove fatal to such an attempt; and, even supposing they had so far succeeded, how are they to drag—for that's the assumption—this very elastic piece of mechanism from its strong and deep-rooted attachments? The thing seems to be impossible, and we need not fear that our allusion to it will induce any future *felo-de-se* to prefer it to the easier and speedier alternatives of a jump over London bridge or a resort to the ever ready razor.

But we must hurry on to a close, and with this view restrict ourselves to one or more illustrative extracts of the character here contemplated. Describing the decisive battle that took place between the forces of Mahommed Shah Adily and those of the

famous Akbur, Major Briggs says (Rise of the Mohammedan Power in India), that the former's commander-in-chief, one Hemoo, was pierced in the eye with an arrow, which penetrated the brain; "he sunk into his howda from extreme agony; and the greater part of his troops fearing that his wound was mortal, left him. Raising himself again, Hemoo drew the arrow from his head, and with it the eye from its socket, which he wrapt up in his handkerchief. He continued to fight with unabated vigor until he contrived, with the few men who remained faithful to him, to force his way through the enemy's line." That a brave man should continue to fight for dear life after he had lost an eye, in battle or otherwise, is no very uncommon or extraordinary thing; but that he should do so under the circumstances here disclosed is certainly unusual, and if such wounds as are casually inflicted in this region by the poke of an umbrella handle or the thrust of a walking-stick prove, as we believe they always do, fatal, we may well doubt the practicability of the feat narrated above.

A writer in the "Philosophical Transactions," (A New Abridgment, Vol. IV., pp. 106-7) gives such an account of the effects of a cancer on the brain of a certain person as, if verifiable, would go far to show that Shakespeare's belief, "the man is dead when the brains are out," admits of some qualification. This account may, for brevity's sake, be summarized as follows:—A certain man "had a cancer which spread itself, in spite of the endeavours of the most eminent surgeons of the day, over all the cheek, into his mouth, and across the upper part of his nose, where it perforated the bone and ate away all the flesh round his eye, so that he could take out the latter with his own hands," and we suppose, though this is not actually said, put it into his pocket. It finally exposed the dura mater, and with it the brain itself to view, several portions of which came away. "And what was most extraordinary was that he perfectly retained his senses, and rose every day to dress the ulcer himself till a considerable quantity of the brain had come away." When he died, four days after taking to his bed for the last time, "his brain *was totally consumed*, and nothing remained in the cranium but a small quantity of black putrid matter," and we are gravely asked by this philosophical writer to believe this.

Were we to do so, we would be simply flying in the teeth of all experience, and reducing the researches and observations of our best scientists to a level with the wild exaggerations of Mr. Holloway or St. John Long. This we decline to do, and if a man may go about his ordinary business without any brains, there is no good reason why he may not do the same without his head, or why, in a word, the miracle of St. Denis may not be reproduced, *puris in naturalibus*, any day, at the Egyptian Hall or elsewhere, in our very midst.

A CHINESE COLUMBUS.*

In the year 499 of our era there appeared at the city of King-Cheu a Buddhist bonze, or priest, who told some very wonderful tales about his wanderings,—so wonderful, indeed, that the Bureaucracy of the day wrote down the most credible of them in the annals of the empire. Of course we are all thoroughly conversant with the history of Chinese political affairs, and do not need to be reminded that at this momentous epoch Tonghoenheu, the celestial Cæsar of the day, was besieged in his palace at the above named city by his no less celestial brother; that this brother, being the stronger, was declared "Protector of the Empire," and resided at King-Cheu where he soon after deposed the sluggard, Tonghoenheu, and ascended the throne in his stead. But rebellion breeds rebellion, and the last monarch of the Tsi dynasty soon had to succumb to the superior prowess of Liang Wu-ti who mounted the throne as founder of the Liang dynasty.

Now the monarchs of the Tsi dynasty were very good sort of people in their way, but they had not been sagacious, or pious, enough to embrace the Buddhist religion. On the contrary, Wu-ti, like his western prototype, Constantine, saw "which way the cat was going to jump" and entered with ardor the "way" of Sakyi-Muni and became the patron of Buddhism. So that while Hwui-Shan, the bonze before mentioned, arrived at King-Cheu in 499, A. D., the unsettled condition of affairs and the natural incredulity of a gentile court prevented him from telling his story to sympathetic and attending ears till 502, when Wu-ti became emperor. Doubtless he was kept dancing about from camp to court, cooling his heels in ante-chambers, much after the fashion practiced on Columbus a thousand years later, in the interval between his appearance and his recognition by the new monarch. Shortly after the accession of Wu-ti, however, it is related in the memoirs, Liang-sse-kong-ki, that an envoy from the Kingdom of Fu-sang presented himself and offered divers productions of his country. The Emperor was at once interested and ordered his minister, the Lord Yu-kie, to interrogate the embassador about his country as was the custom. It is stated in these memoirs that the envoy wept (why this pathos was manifested is not plain) and responded with "respectful ardor;" but nothing is here told of his answers or his presents to Wu-ti, (except that he displayed 300 pounds of "silk" made from the Fu-sang tree) though it is said that the Lord Yu-kie in after years, won a great reputation as a story-teller by rehearsing, with comments and adornments, the Fu-sang

*An Inglorious Columbus; or, Evidence that Hwui Shan and a party of Buddhist Monks from Afghanistan Discovered America in the Fifth Century, A. D. By Edward P. Vining. New York: D. Appleton and Company, 1885.

envoy's narratives. Neither is there anything here said which connects our friend, Hwui-Shan, with this embassy, except in the circumstantial way described. At any rate, the probabilities of the bonze and the envoy being identical are quite as well founded as most historical speculations. Especially does this appear true when we find in another Chinese book a statement that "the officials of the Tsi dynasty make no mention of him (Hwui Shan) and it is the books of the Liang dynasty which contain the account of Hwui-Shan regarding "Fu-sang."

Now for the story that Hwui-Shan, or the envoy, told.

Li-yan-cheu, an author who lived about the commencement of the seventh century, in the Nanszu, a book of annals, relates the arrival of the bonze, Hwui-Shan, as stated, and his story is given,—perhaps in the very words with which Yu-kie transcribed it. The historian, Ma Twan-lin, a contemporary of Marco Polo, copied this relation into his famous work, the "Antiquarian Researches;" and it was also copied into the great Encyclopedia known as Wen-hien-tong-kao. Li-yan-cheu adds to the statements in Hwui-Shan's narrative that Fu-sang was unknown to the Chinese, prior to the year 458, A. D. This is the narrative (I use Mr. Vining's translation as being, perhaps, as authentic as any other) in full, as given by Ma Twan-lin:

"FU-SANG."

"In the first year of the reign of the Tsi dynasty, known by the designation of Yung-Yuen, or "Everlasting Foundation," (*i. e.* in the year 499, A. D.,) a shaman, or Buddhist priest, named Hwui-Shan, came to King-Cheu from that country, and narrated the following account regarding the country of Fu-sang, (or Fu-sang kwoh.")

" 'Fu-sang is situated twice ten-thousand *li* (Chinese miles), or more, to the east of the great Han country. That land is also situated at the east of the Middle Kingdom, (China). That region has many Fu-sang trees, and it is from these trees that the country derives its name. The leaves of the Fu-sang resemble—[1] and the first sprouts are like those of the bamboo. The people of the country eat them and the (or a) fruit, which is like a pear (in form,) but of a reddish color.[2] They spin thread from its bark from which they make cloth, of which they make clothing. They also manufacture a finer fabric from it.[3] In constructing houses they use planks, such as are generally used in building adobe walls.[4] They have

1 De Guignes: "Those of the tree which the Chinese call tong;' Klaproth: 'those of the Toung (Bignonia Tomentosa;') Neumann: 'the Dryandra Cordifolio;' de Rosny (the Japanese account:)'the To tree;' Julien: 'the Thong tree (Paullownia Imperialis;') d'Hervey: 'the Tong tree' (according to Leland, the Dryandra Cordata, or Elæococea Verucosa;) Williams: 'the Tung tree.'

2 All the translators state that the first sprouts are eaten; but our author is the only one of them who states that the fruit is also eaten; the others merely describe it.

3 The Japanese account doesn't mention the finer fabric.

4 DeGuignes says the boards are made from the Fu-sang tree, and states that these "are employed in the construction of their houses;" Klaproth says nothing about their use in "building adobe walls;" Neumann: "Their houses are made of wooden beams;" Julien: they "construct houses of planks," etc.

no citadels or walled cities.[5] They have literary characters and make paper from the bark of the Fu-sang. They have no military weapons or armour, and they do not wage war in that kingdom.[6]

According to their rules (of government, or of religion) they have a southern and a northern place of confinement. An offender who has transgressed but slightly, enters the southern place of confinement; but if he has sinned heavily, he euters the northern place of confinement. If there is pardon for him he is sent away to (or, possibly, from) the southern place of confinement, but if he cannot be pardoned, then he is sent away to the northern one.[7] The men and women dwelling in the northern place of confinement, when they mate (or have mated) and bear (or have borne) children; the boys are made slaves at the age of eight years, and the girls at the age of nine years. The criminal, (or the criminal's body) is not allowed to go out up to (or at) the time of his death.[8] When a nobleman has committed a crime the people of the country hold a great assemblage and sit in judgment on the culprit in an excavated tumulus. They feast and drink before him, and bid him farewell when parting from him, as if taking leave of a dying man. Then they surround him with ashes there.[9] For a single crime (or a crime of the first magnitude,) only one person (the culprit) was hidden (or sent) away. For two crimes (or a crime of the second magnitude,) the children and grandchildren were included in the punishment. For three crimes (or a crime of the third maguitude,) seven generations were included in the punishment.[10]

The title of the King of the country is *Yih-kee* "the chief of the multitudes." The noblemen of the first *Tuilu*; those of the second rank *Little Tuilu*; and those of the third rank *Natosha*. The king of the country, when he walks abroad, is preceeded and followed with drums and horns. The color of his garments is changed according to the mutations of the years. The first and

5 Klaproth says "there are no cities or walled habitations;" the Japanese account is similar; Williams: "there are no walled cities with gates."

6 De Guignes: "they love peace;" Klaproth: "have no weapons, or armies;" Neumann: "have no weapons;" de Rosny (Japanese account:) "have no offensive weapons or defensive armour;" Julien: "have neither armies or lances;" d'Hervey: "have no soldiers;" Williams: "no mailed soldiers." All but de Guignes agree that the text says they do not wage war; he omits any reference to this fact.

7 De Guignes: "the most guilty are placed in the northern prison, and are afterwards transferred into that of the South, if they obtain their pardon; otherwise they are condemned to remain all their lives in the first." D'Hervey says, "they never can be released" from the northern prison, and Williams: "Criminals, when pardoned are let out of the southern prison; but those in the northern prison are not pardoned."

8 Neither de Guignes, Neumann, or d'Hervey make this statement.

9 Neumann says, "they bestrew him with ashes;" and de Guignes, "those who have merited death are buried alive in ashes."

10 De Guignes, speaking of the criminals "buried alive in ashes," says "their posterity is punished according to the magnitude of the crime;" Klaproth: "For an offense of little gravity the criminal alone is punished, but for a great crime the culprit, his sons and grand-sons, are punished; finally, for the greatest offenses, his descendants to the seventh generation are included in the punishment;" Neumann, instead of grading the crimes, grades the criminals, that is the punishment is graded as above, according as the culprit is of "low rank," "high rank" or "highest rank;" Julien states that these punishments are inflicted according as one, two or three crimes were committed; d'Hervey and Williams grade the magnitude of the crime.

second years, (of a ten year cycle) they are blue (or green), the third and fourth years, they are red; the fifth and sixth years, yellow; the seventh and eighth years, white; the ninth and tenth years, black.[11] They have cattle horns, of which the long ones are used to contain (some of their) possessions, the best of them reaching (a capacity of) twice ten times as much as the capacity of a common horn.[12] They have horse-carts, cattle-carts and deer-carts. The people of the country raise deer as cattle are raised in the Middle Kingdom (China). From milk they make Koumiss.[13] They have red pears kept unspoiled throughout the year and they also have tomatoes.[14] The ground is destitute of iron, but they have copper. Gold and silver are not valued. In their markets there are no taxes or fixed prices.[15] When they marry it is the custom of the son-in-law to go and erect a house (or cabin) outside of the door of the dwelling of the young woman (whom he desires to marry). Morning and evening he sprinkles and sweeps (the ground) for a year, and if the young woman is not pleased with him, she then sends him away; but if they are mutually pleased, then the marriage is completed, the marriage ceremonies being for the most part, like those of the Middle Kingdom (China). For a father, mother, wife or son,[16] they mourn for seven days without eating. For a grand-father or grand-mother they mourn for five days without eating; for an elder brother, younger brother, or father's younger brother, or for the corresponding female relatives, or for an elder sister or younger sister, three days without eating.[17] They set up an image of the spirit (of the deceased person) and reverence it, and offer libations to it morning and evening. In their mourning usages they do not wear mourning garments, or mourning badges. A king who inherits the throne does not occupy himself with the affairs of the government for the first three years after his accession. Formerly they were ignorant and knew nothing about the Buddhist religion; but during the the reign of the Sung dynasty, in the second year of the period

11 De Guignes, "he changes the color of his garments every year."

12 De Guigues: "The cattle of the country bear a considerable weight upon their horns," Klaproth: "The cattle have long horns, upon which burdens are loaded, which weigh as much sometimes as twenty ho, (of 120 Chinese pounds);" Neumann; "the oxen have such large horns, that they contain as much as ten sheep-skins; the people use them to keep all kinds of goods;" Julien; "they have cattle whose horns are very long, and who bear upon their horns a weight as great as twenty ho;" d'Hervey; "Ox horns are found in Fusang, so large that their capacity is sometimes as great as two hundred bushels. They are used to contain all sorts of things;" Williams: "There are oxen with long horns, so long that they will hold things—the biggest as much as five pecks."

13 De Guignes, Klaproth, Neumann, de Rosny, d'Hervey and Williams, state that the milk is obtained from female deer. None of them call the product Koumiss; some calling it "cream" others "butter," others "cheese," and d'Hervey simply says the milk "makes part of their food."

14 De Guignes says, instead of "tomatoes," "iris and peaches;" Klaproth, 'many vines;' Neumann, "apples and reeds, mats being made from the last;" Julien and d'Hervey, "many grapes;" Williams, "water-rushes and peaches."

15 Neumann says that gold and silver "do not serve as the medium of exchange in the markets."

16 The others have "parents" except de Guignes.

17 The others do not say about relative ages except Neumann who says "younger brother or sister," and d'Hervey who says, "without distinction between the elder and younger."

called Ta-ming (or Great Brightness, i. e., in the year 458, A. D.), from the country of Ki-pin (i. e., Cophene, now Cabul), formerly, five men who were pi-k'iu (i. e., bhikshus, mendicant Buddhist monks) went by a voyage to that country, and made Buddha's rules and his religious books and images known among them, taught the command to forsake the family (for the purpose of entering a monastery), and finally reformed the rudeness of its customs."

The first question that arises upon reading the above narration is where was Fusang? And it is this question that Mr. Edward P. Vining essays to answer in his book "An Inglorious Columbus." He is of opinion that Fusang was Mexico, and we will now examine his arguments.

It must be premised, however, that this question has been the subject of much controversy. Originally started by de Guignes in 1761, it has received attention pro and con from Klaproth, de Paravey, Neumann, Perez, d'Eichthal, Saint Martin, Adam, Leland, Williams, Bancroft and others, and has alternately been patronized and discountenanced by savants. Those who have advocated an American *locus in quo* for Fusang have differed very widely as to the exact position it should occupy on the map. De Guignes thought it some point on the north-west coast of America; de Paravey located it in Oregon, at first, then California; Neumann, d'Eichthal with Leland and our author do not doubt that Mexico or Central America answers the description.

It will be noted that Fusang is situated, according to the account of Hwui Shan, twenty thousand *li* to the east of the great Han Country, and that it is also to the east of China. This raises two questions: (1) where was the Great Han Country, and (2) what was the length of the *li* in the fifth and sixth centuries? Of course there have been a variety of opinions as to the location of Tahan, or the Country of Great Han. De Guignes thought he had found it in Alaska by tracing an itinerary of a land route to that country, mentioned in the Chinese books, and making it end in Kamtchatka. Recent authorities have discovered, however, that there were two countries known as Tahan—Tahan of the North, situated in Siberia so far north that the day only sufficed in length "to roast a breast of mutton," and Tahan of the East, which could only be found by coasting northward along the seaboard of China to a point seven thousand *li* to the northeast of Japan, known as the "Land of Marked Bodies," and from thence sailing five thousand *li*, or more, to the east. It will be observed from this that Fusang was situated at a distance of 33,000 *li* from Japan. According to de Rosny's correction of Ma Twa-lin (who gave the distance as 12,000 *li*) the distance from Lolang, or Laifang, to Japar was one thousand *li*, making the route from China to Fusang 34,000 *li* in length. Now what was the value of the *li* at that time?

While it is true that the distance on Chinese roads as given by ancient books ought to furnish some help there is really little profit to be derived from them. The *li* of China and Corea differs very widely, and yet there is every reason to believe that distances were frequently given without regard to this difference. Corea was situated on the direct route to Japan, and it is quite probable that information obtained from the Coreans, respecting distances, was carried back to China by navagitors and helped to confuse the subject. Yet there is, after all, a very general consensus of authority that the ancient Chinese *li* was about one-third of an English statute mile —about 1,700 feet. Using this as the basis of calculation, it will be found that Fu-sang could be reached from China by a voyage 11,000 miles. The general direction of this voyage being to the east, where would the navigator reach his journey's end? By glancing at a globe it will be seen that a ship sailing north-eastwardly from the southern coast of Japan, would reach at a distance of about 5,000 *li*, or 1,300 miles the eastern shore of Kamtchatka, or the Aleutian Island; from thence sailing east 7,000 *li*, or 2,300 miles it would arrive at the country of Tahan, or the main island of Alaska; from thence sailing in an easterly direction a voyage of 20,000 *li*, or 6,600 miles, carries it to the shores of southern Mexico—a country lying eastward of Tahan and China alike. This is, briefly, the position of Mr. Vining, and having thus arrived at Fusang let us see whether we find there the products, the customs, the laws and policy described by Hwui-Shan, and, above all, whether the religion of Buddha can be traced in the ceremonials and tenets of native cults.

First, then, as to the products. The most remarkable of these, the one from which the country took its name, was the Fu-sang tree. The leaves of this tree were said to resemble the Tung tree; but no two translators agree as to the tree thus designated by this name, and thus we get no aid in identifying it from this statement. But it was also asserted that the young plant resembled bamboo-shoots, and were edible; that its fruit was pear shaped and reddish in colour and from its bark threads were spun and woven into cloth, both coarse and fine; and that paper was manufactured from it. Is there any plant in Mexico that answers in any measure this description? If such a plant exists it would have attracted the attention of the Spanish conquerors and been classed among the most valuable products of the land. Most of us have seen the century-plant and are acquainted with its marvelous properties and uses. In Mexico it is called the Maguey, but its botanical name is *Agave Americana*; and it has been suggested that this was the plant Hwui-Shan attempted to describe. The objection that it is not a tree is untenable for the reason

that the Chinese place many plants in the list of trees which are only shrubs, and even early authors like Acosta and Gage, struck by its lofty flowering-stalk, follow Hwui-Shan's example and call the Maguey a "tree." As to its uses Acosta states: "The Maguey is the tree of marvels, to which the Indians are accustomed to ascribe miracles, inasmuch as it gives them water, wine, oil, vinegar, honey, syrup, thread and a thousand other things. It is a tree which the Indians of New Spain esteem very highly." Clavigero, speaking of the *Agaves* to be found in Mexico, says: "Some species furnish protecting enclosures, and afford impassable hedges to other objects of cultivation. From the juice of others are extracted honey, sugar, vinegar, pulque, and ardent spirits. From the trunk and thickest part of the leaves, roasted in the earth, an agreeable food is obtained. The flowering-stalks serve as beams, and the leaves as roofs for houses. The thorns answer for lancets, awls, needles, arrow-heads, and other cutting and penetrating instruments. But the fibrous substance of the leaves is the most important gift of the agaves of Mexico. According to the species, the fiber varies in quality from the coarsest hemp to the finest flax, and may be employed as a superior substitute for both. From it the ancient Mexicans fabricated their thread and cordage; mats and bagging; shoes and clothing; webs equivalent to cambric and canvas; the hammocks in which they were born and in which they reposed and died, and the paper on which they printed their histories, and with which they adored and adorned their Gods. * * * It is not, therefore, surprising that the ancient Mexicans used some part, or preparation, of these plants in their civil, military and religious ceremonies, and at marriages and at deaths; nor that they perpetuated an allusion to their properties in the name of their capital.

It is objected, however, that it is the bark, and not the leaves, of the Fu-sang tree that furnished the fiber for textile use and that it bore a reddish pear. But the Abbe Brasseur de Bourbourg made the same mistake as Hwui-Shan (unless Yu-Kie was the real culprit) in this particular, though he was well acquainted with Mexico and her products, for he says, in one place, that the Cokchiquels made garments from the *bark* of trees and of the Maguey and, in another, that the Mexicans get hemp from the *bark* of the Maguey. As to the pears it may be said that the Chinese are rather "scattering" in terminology, and it would not be a wider applciation of the term *peae* to call the seed-pod of the Agave by that name, than to call the pod of the cotton plant "the Flossy Blossoming Peach," as the Chinese do. The people from Fu-sang also made paper from their tree; so did the Ancient Mexicans from the Agave.

There is then a very remarkable

coincidence in the characteristics of the two plants if they are not the same.

Another production of the Fu-sang country was immense cattle horns—capable of containing, says the account, as much as twenty common horns. At the time Mexico was entered by the Spaniards, it is true, no cattle were to be found there, but it is related in one of the histories of the Spanish conquest that Montezuma showed his conquerors "as a curiosity, cattle horns of enormous dimensions." And Humbolt relates the finding of monstrous cattle horns in ruins in south-western Mexico. It is known that there is a species of sheep in the Rocky Mountains known as "Big-horns," from the remarkable development of their horns. At the time of the conquest these sheep had been exterminated in Mexico, just as the Bison has since been exterminated east of Colorado, and could only be found in much the same range as now. Coronado, in his celebrated raid to the north, saw sheep "as big as a horse with very great horns." He also saw one horn which he exhibited to his army, a fathom and a half in length, and as large at the base as a man's thigh. Surely such animals are worthy of being called cattle, and it is quite likely they were still to be found among the mountains of Anahuac 1,500 years ago.

The various kinds of carts mentioned are not so easily accounted for. Though we cannot be certain that carts were never used by the American aborigines we have no authentic notice of their use. The Indians of the west, and very likely the Aztecs too, used dogs to draw rudely improvised sledges made of lodge-poles, upon which they loaded their effects. And as to the raising of deer, it is a well attested fact that the Aztecs kept preserves and had large herds of deer.

The red pears, if not the same mentioned as the fruit of the Fu-sang, are easily found. Either the prickly pear or the persimmon would answer the description, as both are kept "unspoiled throughout the year." Tomatoes, if that is the true translation, were a favorite vegetable with ancient Mexicans, and we have acquired their liking for it.

As for minerals it is known that the Aztecs did not use iron but used copper instead, that gold and silver were merely used as ornaments by them, and never as a medium of exchange.

In speaking of the various carts in use, the term "horse-cart" is used. Now it was thought to be well settled that the horse was extinct in America when the Spaniards arrived; but of late several investigators have found reason to doubt this. Capt. Berthoud in the Review for November, 1881, gives reasons for thinking that horses existed in South America and were seen at the time of its discovery; and Dudley says that Drake found many wild horses at the northward (on the Oregon coast)—at which

he wondered, because the Spaniards had never found horses in America. The author of Bryant's History of the United States, commenting on this statement, says: "It is customary to account for the immense herds of American horses on the assumption that the Spaniards introduced them. Drake's visit, however, to Port New Albion was but thirty-eight years after Coronado's visit to Cibola, which as we now know, was at least five hundred miles away. It is difficult to believe that a few stray horses from Coronado's troop, should, in so few years have multiplied into large herds as observed by Drake on the distant sea-board at Oregon."

From these considerations and the well known fact that the fossil horse of America is identical with the wild-horse, it does not seem improbable that the ancient inhabitants of Mexico used horses as draught animals.

[TO BE CONTINUED.]

SOME OF THE WONDERFUL PRODUCTIONS OF THE SEA.*

Among the few sea-flowers that we have already touched upon, none are more important than the "reef-building corals" of the torrid zone, to which we have already alluded. The very gaudiest live among the coral reefs. There these sensitive flowers of the ocean build their submarine palaces, gliding from coral branch to coral branch, and from one lustrous petal to another. It is not to be wondered at that these little creatures, growing like plants, assume all forms of vegetation. Among them we find lichens and mosses, leaves and columns, shrubs and trees. And all these various shapes, in every instance, proceed from a single germ, which grows and buds under a few simple laws of developement. Everywhere, throughout this region, the eye is charmed with the brilliancy of color. Take the yellow lilac fans of the "Gorgona," worked like jewelry in filagree; the elegant "cup" coral with its pure translucent white, tinged with a delicate rose and variegated with the richest chestnut; the rare "tuft" coral, like a massive, thickly-branched tree, with its individual corals set upon one common stem; the "organ pipe," its tubes arranged like the pipes of a church organ, and beautiful in the extreme in its pink and light green, contrasting finely with the structure it so wonderfully raises. These, with hosts of others, shine in the darkness like "fairy stars," and in a very singular way accomplish their gigantic work.

These massive structures are all of great beauty; but *how* are they reared? Let us see. In the hot summer months, millions of jelly-like spawns are thrown off by the parent animal. For awhile they enjoy their freedom and revel in the exercise of

*From Journal of Education.

their locomotive powers; but soon becoming tired, they settle down upon some firm, stationary body. At once they prepare to take on a different form, becoming star-like in their appearance, with tentacles around the mouth, very much as leaves surround the center of a flower. After awhile each one of these ray-like parts pushes out extensions, which, in their turn, assume the shape of tiny stars, and establish their own existence by exhibiting an independent mouth. These polyps are all soft-bodied organisms, consisting of many varieties and having the organic functions of secreting carbonate of lime, which, with some other ingredients, as silica, and small portions of sand, compose the hard substance we call coral.

The body of the polyp consists of a cylindrical skin, with an inside sac, which is the stomach, and is furnished with little thread-like appendages with which it draws in its food, and it is between the outer skin and this sac or stomach that the limestone is secreted which forms the coral substances. It is a very common mistake to suppose that the coral producers are *laborers*. Nature has simply provided that in receiving their food the polyps should select from the ingredients of the sea-water that which is capable of being reduced by simple functional processes into coral, just as a plant selects and secretes from the earth that kind of nourishment which makes stems, leaves, and buds.

And so these beautiful creatures, these living sensitive animals moving at will and clad in the gay forms and bright colorings of a flower, are really the very *flowers* themselves; and what we call coral are not retreats into which the coral coloring comes and goes like a bird building her nest, but part and parcel of the creature itself; just as much so as are bones belonging to the human body, with this difference,—that in the case of the polyp, the stony part (representing the osseous structure of man) is all at the lower portion, while the upper part is soft and flexible, but in a healthy human body they are inseparably combined.

Naturalists have found out of late that the industry of these polyps does not consist in *building*, as hitherto supposed, but in *eating*, bringing about, as a result, a strong, stony structure, which must necessarily be slow in its formation. The denser the deposit the more valuable the coral. No one has seen just how these marvellous dwellings are built. It is a God-given power; and yet, what piles of stone are accumulated by these minute creatures,—as some one has said, "reared for eternity."

There are few natural objects more pleasing than a company of these corallets; for as the polyps rise above their cells and extend their fine, long tentacles,—resembling threads of pure white silk,—waving them to and fro like the radiated petals of a fairy-flower swayed by a gentle zephyr, or like a minute fan slightly concave at

the edge, they present an exceedingly elegant appearance, and when quietly at rest they are said to be like "hoar frost on bed of moss."

But these fairy-like implements with which the coral polyp gathers in its food are not such innocent objects as they appear to the naked eye. If you could see them under a glass you would find on the tentacles a row of slight protuberances, one at the tip longer than the rest. This is the little creature's armory, for concealed within them are lasso-like filaments, called capsule threads, which they can throw out many times the length of the body. With these they capture their prey, paralyzing them by the fluid therein contained.

These are called *cridæ*, or thread capsules, because the small sheaths containing these slender threads are coiled, ready for use, and are darted out so rapidly when any victim comes within reach. The shock, however, is much less severe than that from the anemones, of which we have already spoken. The food of the polyp is always digested before the animal retires within its cell, or *calcle*.

In the Coralidæ the calcareous matter is firm and solid throughout, and all of a color, varying from crimson to rose-red. In the *corallium rubrum*, the red, or precious coral, the outer crust resembles the bark of a tree, and may be readily rolled off in this species. The true coral is the red axis, which it envelops, which is like a six-rayed star. Some shades are immensely valuable. The real *rose-pink* is much sought after, and will bring twenty-five times its own weight in gold, and is always sold by the *ounce* or *pennyweight*. It is found from thirty to a thousand feet below the surface of the sea.

Black coral, *Corallium nigrescens*, is still more scarce.

These massive forms of coral would never reach their vast proportions if it were not for nature's peculiar provisions: Life and death, occurring simultaneously, each aiding in one and the same object. Each mature polyp when fixed in its cell may be considered as resting upon the tomb of its ancestors, and when it dies *its* descendants will repeat the process over its remains, and its own body, within which its share of coral had been secreted, will be the base of a new living descendant. What marvels we find at every step of the way!

The variety of corals are very numerous and all extremely interesting and beautiful, but as this chapter is mainly designed to encourage further investigation, we shall not go on with any lengthened description.

The more we study the mysteries of the ocean the more we shall see that every living being, even to the most minute, is perfect in itself, and that the almost unknown body of the *stone* animal is as fearfully and wonderfully made, as that of man himself; while all, by the astounding wisdom of God, are constituted most favorably for the purposes they are designed to fill in the kingdom of nature, and are working together for

His good who formed them for His own especial service!

"Then study Nature with reverence high,
And she will give the key,
So shalt thou learn to comprehend
The 'Secrets of the Sea.'"

THE FRENCH ACADEMY IN ITS ORIGIN.*

"I undertake, since you request it, to write down what I know of the French academy,—a society about which many people talk, but which few people know as it ought to be known."

These are the words with which Pelisson, the original historian of that famous society, began his narrative. Notwithstanding the charm of his graceful style, the exact additions to the record which were made by the Abbe Olivet, and to the much more recent notes of Livet, to say nothing of Kerviler's readable bibliography, and Arsene Houssaye's witty and satirical criticism, the French academy remains to this day, as it was in 1653, when Pelisson's story was first anonymously published,—"a society about which many people talk, but which few people understand." Now and then some enthusiastic English or American writer proposes an English or an American reproduction, or a critic skilled in the poise of conflicting ideas sets forth the possibilities and the difficulties of organizing such an imperial agency, amid the decentralized institutions of Great Britain and the United States. Mathew Arnold concludes his famous essay on this subject by a sentence in which admiration is tempered with doubt. "An academy," he says, "quite like the French academy,—a sovereign organ of the highest literary opinion, a recognized authority in matters of intellectual tone and taste, we shall hardly have, and perhaps we ought not to wish to have it." We may venture to add, that, if London cannot have its literary court to exercise an acknowledged supremacy within a prescribed domain, New York and Washington must wait awhile before their political or financial power can originate a society which will be potent in the promotion of letters. Nevertheless, the growth of the French academy, and its influence upon the scientific, as well as the literary progress of France, are quite worth studying. It is the parent of the Institute of France, but it is the child of a modest coterie of literary people such as may be found in almost every cultivated town. Its extraordinary growth is due in no small degree to that innate love of symmetrical organization, or of good form, which the French exhibit in many phases of activity. It owes not a little to the power of the monarchy in the days of Louis XIV.

The French academy is always spoken of as founded in 1635, but several years before that date its nucleus was in existence. As early as

*Science, for August.

1629, a number of bright men in different parts of Paris, suffering from the impediments of a great city, and finding it inconvenient to pay visits without finding their acquaintances at home, determined to have a weekly meeting at a private house. They were men of letters, above the average ability, associated like our literary clubs, by the principle of good-fellow-ship, with the slightest possible regulations, and having at first no higher purpose than familiar and friendly conversation on business, news and literature, the interview ending with a promenade or a collation. If any of the company wrote something on which he wished genuine criticism, here was his opportunity to receive unguarded and honest comments. In later years the members of the academy looked back to this golden age of its infancy, when all that is bright and charming in literary society was enjoyed without noise, parade, or animosity. To avoid the intrusion of unwelcome fame, even the fact that there was such a club was for a long time not mentioned to those who were unconnected with it. But such could not long be hidden beneath a bushel. One by one, outsiders heard of that charming circle which was not engaged in the exchange of compliments and flattery, but which openly and boldly pointed out to the members their literary faults. All this Arcadian chapter is charmingly told by Pelisson, whose narrative we are following as others have so often done before. Boisrobert was then in high favor with Richelieu,—the one to whom the Cardinal's physician referred when he said, "Monseigneur, I can prescribe nothing more for you, but two drachms of Boisrobert after dinner." From this source the great minister of France heard of the brilliant coterie which met at the house of Couvart. The far-sighted sagacity of Richelieu perceived the possibility of giving public authority to these self-contained critics, and through Boisrobert he offered to become the protector of the club, and to give it the authority of *Lettres patentes*. His proposals were gladly accepted as honors from the crown, * and after due deliberation and formalities, the charter passed under the royal hand and seal in the month of January, 1635. This document is far more interesting at this late day than most such official papers. It abounds in lofty sentiments admirably expressed. It recognizes the conferences which have been held by the pre-existent assembly; it confirms and defines their purpose to be the promotion of eloquence, that is to say, of skill in the use of language; it bestows upon the infant society the name which has

* The writer is here following Pelisson, who wrote at a time when the truth could not be spoken. Guizot says that the proposal was received with consternation, and that scarcely a member of the voluntary society did not testify displeasure. The argument of Chapelain that "they had to do with a man who willed in no half-hearted way whatever he willed, and who was not accustomed to meet resistance or suffer it with impunity," and that "he would consider it an insult to disregard his protection and visit his resentment upon each individual," shows quite explicitly the inducements that led to the acceptance of the proposal.—W. W.

now become historic; it limits the membership to forty persons; and it confers upon the cheif and protector, Cardinal Richelieu, the authorization of officers, statutes and by-laws. Various other names had been proposed,—*l'Academie des beaux esprits*, *l'Academie de l'eloquence*, *l'Academie eminente*,—but finally *Academie francaise* was selected, because it was more modest and more appropriate.

The original statutes define in much detail the sphere of the academy, and its methods of procedure. Its purpose is thus stated in the twenty-fourth article. "The principal function of the academy will be to labor with all possible care and dilligence to give certain rules to our language, and to make it pure, eloquent and capable of treating the arts and the sciences." In subsequent paragraphs, provision is made for the distribution of the best French authors among the academicians who are to make a note of such words and phrases as suggest general rules of correct expression, the entire academy to be the judge of what is thus presented. The preparation of four works—a dictionary, a grammar, a rhetoric, and a poetry—is projected. At every regular meeting, one of the academicians, in his turn, is to present a discourse in prose, reading or reciting it as he chooses. He may select any theme, but must restrict himself in delivery to fifteen minutes, or at most, thirty minutes. The rest of the session is to be devoted to the examination of works which have been presented to the academy, or to the prosecution of the four great tasks already mentioned. Every discourse before the academy is to be referred to two censors, who shall report within a month their observations upon it, and the author, within the following month, shall submit to the commissioners the corrections which he may have made in accordance with their suggestions. Similar steps are to be taken in respect to other works submitted to the judgement of the academy. Brief rules are laid down to make the criticism truly effective. The commissioners or censors are not to keep copies of the papers they examine, nor of their observations upon them; faults are to be pointed out with deference and courtesy. The corrections are to be received in the same spirit; the approbation of the academy will be expressed without praise, and in accordance with a prescribed formula. Works endorsed by the academy, after such scrutiuy as has been mentioned, may be published by order of the French academy; but no academican may indicate his membership in the academy on the title page of a work not submitted to the criticism of his associates, or not approved by their action. The rules which the academy prescribes in respect to language or orthography must be followed by all academicians in prose and verse. All relation of the confidences of the academy, in criticism or praise, is forbidden under penalty of disgraceful and irremediable expulsion.

By these severe methods, the literary men in Paris, in the middle of the seventeenth century, endeavored to hold themselves and their countrymen up to a high standard of literary excellence. The results have been apparent from that time to this, in the clearness, the fitness, and the grace which have characterized French writers, not only those of genius and erudition, but those of humbler standing. In later days, other academies in Paris have shared with the French its lofty rank, and perhaps there is less reason now than there was two centuries ago, for such concentrated action in the improvement of the French language, and in the promotion of a pure style; yet no one can read the story of those primitive days without admiration for the spirit which conceived this lofty idea of the benefits of literary criticism, severe and considerate, and which upheld the advantages of co-operative efforts in the advancement of letters. Among all the literary clubs of the world, none has attained to such acknowledged authority, none has come so near to immortality, none has had such wide-spread influence, as those which sprang into life at the magic touch of Richelieu two centuries ago.

BACTERIA.*

This class of organisms has lately come into great prominence on account of the relations they are known to possess to the causes of disease. In popular articles the term bacteria is less often applied to them than that of microbes or simply germs. They are spoken of as germs from the fact that it is due to their rapid growth and multiplication in the human system that many diseases are produced.

In scientific classification the bacteria belong to the class of organisms known as Infusoria, so called from the fact that they are always found in infusions of organic matter. It is only necessary to add a few leaves or stems of hay or shreds of meat to a glass of water and allow it to stand for a day or two to produce myriads of these organisms. Those who prepare them in this way for microscopic examination would do well to examine the infusion at stated intervals after the time of preparation; for there are very many species of bacteria, and each species has its own generation. In about twenty-four hours after the infusion has been made, a small drop of it placed under the microscope will usually be found to be teeming with minute organisms of a spherical shape. Twelve hours later many others of a rod shape, either straight or wavy, will probably appear. In the course of two or three days still others of a spiral or

*From the Country Gentleman.

cork-screw shape will be present. It is difficult to imagine a scene of greater activity than that which presents itself to the eye at this period. The field of vision is teeming with incessantly active living forms darting hither and thither at every angle, and with the speed and directness of flying arrows. All of the several forms described above will probably be present, and all are constantly active except the small globular ones. These seem to have no power of motion.

The causes of their movements were not well ascertained until within a few years. It is now well established that in the case of several forms the movement is due to the vibrations of cilia, of which there are only two present, one at each end of the body. Imagine a slender rod, straight or waved, with a delicate vibrating hair at each end, and you have an idea of the appearance of these forms.

When it comes to consider the size of bacteria, one must be prepared to receive some very extraordinary statements. The smallest (spherical in shape) are known not to be larger than one thirty-thousandth of an inch in diameter. It seems scarcely credible that bodies so exceedingly minute can be measured with approximate accuracy. But when it is considered that object glasses have been constructed capable of magnifying 2,500 diameters or, by taking the square of this, capable of enlarging the area of an object 6,250,000 times, it is readily seen that a minute body may be so enlarged as to allow its being measured with a near approach to exactness. Taking these organisms then at one thirty-thousandth of an inch in diameter, it follows that 900 millions of them could lay side by side on a surface an inch square. A film of matter one inch square, and one thirty-thousandth of an inch in thickness, if gathered into the form of a sphere, would be very much smaller than a drop of water. We arrive then at the astonishing conclusion that there are living organisms so exceedingly minute that more than a billion of them, or a number equal to the population of the earth, can exist in a single drop of water.

Not less remarkable is the exceeding rapidity with which these organisms multiply. It has been calculated by Cohn, the eminent German investigator, that a bacterium divides into two (they multiply by self-division), in the space of an hour, and that each one thus formed, itself divides at the end of a like time, and so on. At this rate, at the end of twenty-four hours a single organism will have amounted to about sixteen millions and a half; and at the end of a week, it will have multiplied to the incredible extent of requiring a number of fifty-one figures to express it. The same observer has expressed the results of his calculations in another way, by saying that "the bacteria issuing from a single germ would fill the ocean in five days."

The question arises, why these organisms do not overwhelm us with their abundance, seeing that they increase with such great rapidity. The answer is, that their increase is limited to the supply of food. As soon as the food material in a liquid containing them is exhausted, they perish.

Beside multiplying by self-division, they increase by means of spores. These are minute bodies, comparable to seeds, which form in the substance of a bacterium and subsequently develope into new beings. These spores remain alive after the death of the bacterium containing them, whether death be caused by the drying up of the water in which they are living, or by subjecting it to a boiling temperature. It is this fact of the resisting power of the spores to all ordinary destructive agencies that has caused so much difficulty in determining whence bacteria arise, whether, as in the case of all ordinary living things, from a parent organism or, as many for a long time supposed, by a process of spontaneous generation out of the organic matter of the infusion. For it was found again and again, that while all bacteria were destroyed by boiling the infusion containing them, yet, even if it were hermetically sealed before cooling below the boiling point, in a few days it would again be teeming with life. The supporters of the spontaneous generation theory claimed that this was irrefragable proof of the correctness of their view; but those who held to the contrary opinion were finally able to show, to the satisfaction of all, that the organisms which developed in the boiled liquid, sprung from spores which had resisted the high temperature.

These spores are known to be present in all ordinary atmosphere, floating about like fine dust. It is they which cause all forms of putrefaction, whether of animal or vegetable matter. No sooner is any dead organic matter left exposed to the air, than these spores settle upon it, and by their active vital processes cause that fermentation called decay. So that it has been well said that "putrefaction is a concomitant, not of death, but of life." As is well known, decay is prevented by cold; this is not due to any preservative quality in a low temperature, but simply to the fact that bacteria are not able to thrive except under moderate warmth.

As to the chemical decomposition of bacteria, they agree with all the lower forms of life in being made up of the nitrogeneous compound called protoplasm. They are like other forms, too, in consisting in structure of an outer transparent envelope, and a more granular inner part.

A FISH-EATING PLANT.*

Considerable attention has been attracted to the fish-eating habits of the common bladderwort, the first known plant which feeds not merely upon insects and such like inferior creatures, but upon the head and crown of the animal kingdom, the lordly vertebrates in person. Perhaps, therefore, some brief account of the murderous water-weed itself, and of its usual mode of proceeding in capturing its prey, may not be unwelcome at the present time. The plant was known to catch small insects and fresh water crustaceans in its tiny traps, and to use up their bodies as manure for its own development; but it was not yet know to be distinctly piscivorous. Last May, however, Mr. G. E. Simms, of Oxford, England, brought Professor Moseley a specimen of Utricularia in a glass bowl, in which were a number of young roach, just hatched out of spawn lying at the bottom. Many of the small fry were seen dead, held fast in the firm bladder jaws of the murderous plant. Professor Moseley being interested in this wonderful discovery of a fish-eating weed, secured another Utricularia and put it into a separate vessel, with fresh spawn and young fry of roach. In about six hours, more than a dozen of the fish were caught in the wee green gins. In most cases the fish were caught by the head, and when this is so the snout is pushed into the bladder as far as it will go, till it touches the opposite wall, leaving the tail of the poor struggling thing half free outside. Sometimes, however, the bladders catch the young roach by the tail, a fact which proves the truth of Mrs. Treat's view that the valve actually snaps at the prey, instead of merely allowing it to enter it passively. In one of Professor Moseley's specimens, a fish was caught by the yelk-bag, which fry carry in their early stages attached to their stomach: and in another instance two bladders had got hold of the same fish, one trapping it by the head, and the other by the tail.

Seen under the microscope the semi-transparent green traps, with the tiny silvery bodies of the dead fish half protruding from them, form very striking and beautiful objects. The big black eyes of the fish show out clearly, by the transmitted light, through the green wall of the cell that has caught them. Preserved in spirits, the specimens are less interesting, because then the bladder loses its green color, and the force of the contrast is considerably weakened.

After the fish have been for sometime trapped, they assume a slimy deliquescent appearance, and are rapidly absorbed by the glandular processes. As these processes project obliquely backward, Professor Moseley thinks it probable that they help to catch the fish and pre-

*Canadian Science Monthly.

vent them from escaping, in somewhat the same manner as the barbs of a hook or arrow, or as the backward pointing twigs of an eel-buck would do. Each fresh struggle and plunge must make the fish get deeper and deeper entangled in the trap, because the processes, catching in his gill or gill-slits, prevent him from moving backward, and compel him to move forward only.

One word as to the evolutionary history of this singular water-weed. It is a close relation of the beautiful pale green butterwort, whose graceful purple-blue blossoms are found on almost every bog or hilly brookside along the western side of our islands. Butterwort is itself an insectivorous plant, as are all its congeners; and Utricularia is only a butterwort which has taken to live in the water, and has so far adapted itself to its new conditions as to eat fish, as well as insects. By descent the butterworts are probably members of the primrose family, specialized for inhabiting marshy spots; while the Utricularia is a butterwort which has further adapted itself wholly to aquatic life in dirty ditches.

OUR CONSULAR SERVICE.

There is no more important service to the United States at the present time than that performed by our consuls resident in foreign countries. Greely's advice, "Go west, young men," is no longer applicable. The limits of the West have been reached and we are relegated to interior expansion. As agriculturists, we have overstocked the markets of the world with provisions. In this direction we cannot go further, for there are no purchasers at remunerative prices. Our inventors, in all probability, will continue to improve agricultural machinery and thereby lessen the cost of production. This advantage, however, will only enable us to successfully meet competition from other cereal-producing countries, like Russia and India, in European markets. We must, then, look in other directions than the present markets for the disposition of our surplus. These new markets are fortunately at hand south of us, not only on our own continent but in Africa. We are not likely to commit the folly of attempting to colonize, either in South America or Africa, but can, and ought to, form closer commercial relations with these countries. The late South American commission was well enough, but such temporary efforts do not meet the demands of the hour. We need permanent consulates, supplied with experienced and practical men who live in the countries to which our trade is to extend; men who can and will study their needs and advise us how to supply them. The agricul-

tural resources of the countries named are immense and their development is at hand. As pre-eminently the nation of inventors, we can supply the growing wants which development and civilization imply. We have these southern countries at our door. Look south, with the eye on the ocean, and see how it narrows and brings Africa and Brazil close together. Look how West Africa and the southern Atlantic coast of our continent trend toward each other, their rivers emptying into the same ocean on opposite sides. Nor need the development of the vast countries south of us frighten our agriculturists. Their productions are different from ours and invite a change, rather than competition, the very thing needful to commerce. In order to learn the reason why Europeans have succeeded in obtaining the trade of Mexico, and countries further south, it is only necessary to compare and study the consular reports of these countries with those of our own government. Their consular offices are filled by men well qualified to study the wants and resources of the countries to which they are accredited. Their reports are full of the most interesting facts and suggestions bearing on the commerce and resources of the several countries. Their governments rightfully rely on the information thus obtained and, deriving therefrom practical benefit to their commercial interests, they extend to their consular officers proper aid and assistance. Of late years our consular service has improved and done some good work in the direction spoken of. We, however, have not yet given the attention to appointment, with reference to fitness, which is indispensable in order to derive all the benefits from our commercial agents which we are justly entitled to and should possess. Consular offices in foreign countries should be our homes, in the sense of meeting with a welcome when we enter them for commercial purposes or information. Our cousular offices and surroundings should be a substitute for what Europeans call "factories," places where all national commercial interests center, are nursed and cared for. A few thousand dollars properly expended in work about a consular office, in pursuing the policy above pointed out, cannot help but redound to our benefit as a trading nation in a ratio beyond all relation to the disbursement.

WEATHER REPORT FOR AUGUST, 1885.

Prepared by Professor F. H. Snow, of the University of Kansas, from Observations Taken at Lawrence.

A cool, delightful summer month. The number of hot days was only half the average. This is the fourth successive August whose temperature has been below the August mean. The rainfall, wind velocity and humidity were each slightly above the normal amounts. The cloudiness was below the average.

Mean Temperature—73.22 degrees, which is 2.79 deg. below the August average. The highest temperature was 95 deg. on the 8th ; the lowest was 53 deg. on the 26th, giving a range of 42 deg. The mercury reached 90 deg. 7 times. Mean temperature at 7 a. m., 67.35 deg. ; at 2 p. m., 82.88 deg. ; at 9 p. m., 71.34 deg.

Rainfall—3.70 inches, which is 0.11 inches above the August average. Rain fell on 8 days. There were 3 thunder showers. The entire rainfall for the 8 months of 1885 now completed has been 25.54 inches, which is 0.29 inch above the average for the same months in the preceeding 17 years.

Mean Cloudiness—33.87 per cent. of the sky, the month being 1.43 per cent. clearer than usual. Number of clear days (less than one-third cloudy) 15 ; half-clear (from one to two-thirds cloudy) 12 ; cloudy (more than two-thirds) 4. There were five entirely clear days and none entirely cloudy. Mean cloudiness at 7 a. m., 44.52 per cent. ; at 2 p. m., 27.74 per cent., at 9 p. m., 26.13 per cent.

Wind—S. W., 28 times ; N. E., 19 times ; S. E.,19 times ; S., 4 times ; N. W., 14 times ; N.,6 times; E., 3 times. The total run of the wind was 9,124 miles, which is 690 miles above the August average. This gives a mean daily velocity of 294 miles and a mean hourly velocity of 12.26 miles. The highest velocity was 30 miles an hour, on the 20th.

Barometer—Mean for the month; 29.065 inches ; at 7 a. m., 29.089 inches ; at 2 p. m., 29.047 inches ; at 9 p. m., 29.060 inches ; maximum, 29.321 inches, on the 26th ; minimum, 28.778 inches, on the 6th ; monthly range, 0.543 inch.

Relative Humidity—Mean for the month, 71.2 ; at 7 a. m., 82.0 ; at 2 p.m., 53.6 ; at 9 p. m., 77.8 ; greatest, 97, on 11th ; least, 40, on 20th. There was no fog.

The following table furnishes a comparison with the 17 preceding Augusts :

August.	Mean Temperature	Max. Temperature	Min. Temperature	Hot Days.	Rainy Days.	Rain—inches	Thunder Storms.	Mean Cloudiness.	Humidity.	Number of Fogs.	Miles of Wind.	Mean Barometer.	Max. Barometer.	Min. Barometer.
1868	74.17	93.0	57.0	3	6	8.32	5	42.87	..	0	.....	.....	.....	.....
1869	79.30	96.0	56.0	16	13	6.46	3	45.49	78.6	1	.....	29.092	29.235	28.924
1870	73.54	98.0	53.0	11	15	6.69	7	52.80	72.8	1	.....	29.076	29.326	28.761
1871	75.34	100.0	45.0	16	9	2.76	4	39.44	....	0	.....	.....	.....	.....
1872	77.27	97.0	53.0	13	13	4.71	6	33.76	72.0	0	8,698	29.120	29.290	28.867
1873	79.38	104.0	56.0	24	6	0.90	2	23.87	57.8	0	8,190	29.134	29.330	28.974
1874	83.45	108.0	65.0	26	6	1.00	6	24.95	49.0	0	10,099	29.076	29.289	28.916
1875	72.50	91.0	55.0	2	7	2.90	3	32.79	68.1	0	9,484	29.080	29.328	28.919
1876	77.70	94.0	63.0	17	11	4.45	6	26.66	72.4	0	8,235	29.103	29.402	28.794
1877	74.01	97.0	51.5	7	5	2.30	3	29.57	72.0	0	8,572	29.076	29.289	28.916
1878	77.44	98.0	56.0	14	7	2.22	4	19.19	74.6	0	8,188	29.045	29.230	28.879
1879	75.48	99.5	49.0	16	5	1.03	5	28.92	63.8	1	6,835	29.053	29.386	28.801
1880	75.45	101.0	50.5	14	10	7.93	5	45.70	70.1	0	8,863	29.070	29 349	28.859
1881	81.23	104.0	62.0	29	5	1.57	2	31.29	62.5	0	7,991	29.050	29.178	28.875
1882	72.55	95.0	52.5	11	6	0.09	1	32.37	72.4	1	7,463	29.116	29.305	28.935
1883	72.04	92.5	52.0	1	6	2.12	4	39.89	77.0	0	7,640	29.158	29.353	28.885
1884	71.14	98.0	47.5	3	11	5.49	4	48.16	77.8	3	9,392	29.110	29.405	28.849
1885	73.22	95.0	53.0	7	8	3.70	3	33.87	71.2	0	9,124	29.065	29.321	28.778
Mean	75.84	97.5	54.3	13	8	3.59	4	35.09	69.5	0.4	8,484	29.089	29.314	28.871

EDITORIAL.

THE DEAD LANGUAGES AND EDUCATION.

The sounds of conflict are wafted toward us from the East. Pedagogue and Savant are waging the long expected war over the question of the use of Greek and Latin in the schools. The educational and scientific periodicals of that region are full of the matter and we are beginning to feel interested in the West. The truth is, it has long been shrewdly suspected by western people that the knowledge of a couple of languages, spoken for the last time over a thousand years ago, is of very little use to college-bred young gentlemen who find homes among them. It has been discovered that there is nothing in the acquisition of these languages which fits men for the active and pressing duties of life; the very duties that cannot be ignored or broken through by the average youth if he expects to achieve success. When the student leaves college it is very seldom that destiny or talent permits him to seek in "lettered ease" the only recompense for classical erudition. When he leaves his Alma Mater he stands face to face with the world and he cannot avert its buffets, or seize the prizes that await him, by showing familiarity with dead and buried languages. Whatever field of labor he may choose, whatever prizes he may strive to attain, his work henceforward must be practical, and he must bring a practical knowledge to bear, to reach them or to secure any degree of success in the race. In the words of a recent writer:

"However high one's ideal may be placed, however sanguine his hopes may be, the final test of success will be the real and practical.

It becomes a question of considerable interest, therefore, to what extent the ordinary collegiate curriculum provides those following it year after year with this practical knowledge. An examination of that curriculum will show that in every college of this country one study at least has been enforced which has no bearing upon a practical knowledge of the world or its business or industrial methods, and to this extent therefore every graduate is weighed down at the very beginning of the race. This study is Greek. It will show that, including the preparatory course, every student has devoted about five years to this deadest of all dead languages, which can only be made available, and even then to a limited extent, by those who intend to follow the theological profession. Even in this profession, the records would prove that the most successful savers of souls, which we take to be the prime motive of the ministry, have been those who had the least knowledge of Greek and the most knowledge of the vernacular. The examination would further show that Greek has been pursued during these five years to the exclusion of the sciences and practical arts by which

the graduate must earn his living, even if he do not succeed in accumulating a competence. He has given several hours a day to the study of this dead language, which has little or no affinity with his own, to the exclusion of such studies as geology, chemistry, botany, electricity, natural philosophy, political economy, systems of finance, general history, literature, natural history, book-keeping, engineering, and other important courses, some of which must have an immediate bearing upon his future work, and without which he is poorly equipped for his struggle. His Greek will do him no good in the doctor's office, the lawyer's office, the newspaper office, the railroad office, the counting room, the manufactory, on the farm, or in the mine, or the bank. He cannot utilize it in political office or on the rostrum. He can accomplish nothing with it for his own good or for the world's advancement. He has lost a considerable part of his precious five years which should have been devoted to useful studies; and unless he has a very retentive memory he will forget in a few years all the Greek he so toilsomely acquired.

How much better, therefore, would it be if the time which is wasted upon Greek could be devoted to translations of the classics, to general history, to the arts and sciences, and to such modern languages as French and German, not to mention English. Four years of work in these would fit any young man for a good start in the race. It is too late, of course, to benefit those who have already graduated, and if their judgment could be taken, it would be almost unanimous in protesting against the time which was squandered in the study of an absolutely useless language. For the sake, however, of graduates who are to come and who must meet a constantly increasing competition in the struggle for a living, college curriculi should be cleared of all useless studies. The world grows more and more prac tical, and the college should keep pace with it. The studies which have come down from the days of the cloister should give place to those which will enable the graduate to take his place in the densely crowded and eagerly competing throng with some show of success for the prizes."

SCIENCE AND SPIRITISM.

In the August REVIEW a correspondent takes scientific men to task for ignoring, hitherto, the evidence of the truth of spiritualistic claims. While it is quite true that the leaders in modern scientific investigations, with a few exceptions, do not lend credulous, or even interested, attention to the wonders related of so-called mediums, it must be borne in mind that their training and settled habits of thought unfit them to enter this new and mysterious field. They cannot even admit the possibility of the facts alleged; for modern science has been directed undeviatingly towards the reduction of the chaotic phenomena of nature to a body of facts which exhibits the reign of law. Every cumulating discovery, or induction, in science, has helped along this movement until the savant has almost become a prophet—till cause and effect are each only the unknown terms of a problem which can be solved by a knowledge of the other. Now an ad-

mission that, side by side with the orderly procession of nature there exists a disturbing influence, an element which can operate to perturb and annul the laws which govern phenomena and set at naught the wisest induction, is more than can be expected from votaries of science. Such an influence is, in fact, inconceivable to the physicist.

Our correspondent will find in the English *Journal of Science*, for July and August, the opening articles of a controversy on this very subject. The controversy arose over a paper by the eminent zoologist, A. R. Wallace, (who is also a spiritualist,) entitled "Light;" and while his critic opens his side of the case with the statement, "It is no longer possible to ignore the phenomena known collectively under the name of Spiritualism," he proceeds to say: "Science is based upon what we, for want of a better name, term law. Spiritualism rests upon will. Science—and not merely our present Science, but any possible Science, so far as I can conceive it—takes its stand upon the causal nexus, upon the regular sequence of cause and effect. * * * * Now will,—finite will at least—is, I submit, the very antithesis of law. Where will—arbitrium—comes in, we have, of necessity, the arbitrary. The most of us, indeed, * * * have all along recognized one infinite unvarying Will as the ultimate cause of all phenomena. But such Will, being unchangeable and entering at all times equally into all phenomena, occasioned no difficulty. Nor has it been possible to deny that the wills of men and the lower animals * * were capable of interfering to a limited extent and in certain directions with the order of Nature. But, according to what was considered established in the earliest half of the present century, men and animals could act upon anything outside of themselves only where they were personally present, or where there was material physical connection between the agent and the object acted upon. * * * With the advent of Spiritualism all this beautiful simplicity has been swept away. If spiritualists are not mistaken, there are around us numbers of finite, invisible beings, of unknown powers aud unknown intentions, capable of interfering with the order of Nature. * * * To me it seems that if these contentions are true * * * there are introduced, so to speak, into every equation a number of unknown quantities rendering it forever insoluble. We can only say 'such results will follow under certain conditions, if no spirits think proper to interfere.' * * * We are, in short, put to intellectual shame and confusion."

There is another view to be taken of this question which may possibly explain the antagonism of scientific men toward any phase of occultism. We have only just escaped, during this century, from the domination of a thousand superstitious beliefs which weighed upon our ancestors. Ghosts, elves, witches, goblins, were to them the most appalling realities. Their personality entered into the operations of nature, and people forgot the tempest and the plague in horror at the cruel intelligences that animated them. Against these popular superstitions Science made a halting and painful progress; yet every step forward cleared men's eyes more and more to see in the phe-

nomena around them no potency or motivity that did not spring from the operation of the laws of Nature. In time Science was victor over superstition; and is it strange that its votaries are averse to fighting over again the battle with "chimeras dire?" No longer suffering from "the ever haunting dread of the interference of spirits," thanks to science, we cannot return to the "bondage of the Middle Ages."

When spiritualists can harmonize their beliefs with the known and attested facts of science, then they will become science and receive the sympathetic investigation of scientific men.

THE SPENCER-HARRISON IMBROGLIO.

Prof. Youmans' article in the August number of the *Popular Science Monthly*, on the "Suppressed Book," will fail to convince many that the publication of Mr. Harrison's letters, without his consent and with adverse comments, was the fair thing to do; yet the attitude of the English press, and of Mr. Harrison himself, is so extremely unfair that the American public will feel little inclined to censure the act very strongly. The truth seems to be that there was more heedlessness in the matter than desire to do Mr. Harrison an injustice. It is true that it was the duty of the publishers to confer with both parties to the controversy, instead of with Mr. Spencer alone, before publishing; but Prof. Youmans is such a staunch friend of Herbert Spencer, and such a thorough disciple of his doctrines, that he thought only of extricating his leader from the brilliant dialectics of the great Comtist. His mind being single in this purpose, it never occurred to him to communicate with Mr. Harrison on the subject; he was too strong a partisan to look at both sides of the shield, especially as his desire to see Mr. Spencer righted was mingled with considerable indignation over Mr. Harrison's management of the controversy.

Now no one who knows Prof. Youmans, personally or by reputation, would for a moment think him guilty of moral obliquity in any sense. The bad taste and bad manners of Mr. Harrison in designating so eminent a man by the appellation of "cute Yankee editor," as though he were a type of Dickens' Yankee editor in Martin Chuzzlewit, cannot give much credit, in this country, to Comtism as the religion of humanity; and when this is supplemented by innuendoes that covetousness was the motive of Professor Youmans rather than partisan enthusiasm, he puts himself farther in the wrong than his opponents have ever been.

In a recent article in the *Century* it is stated that the only distributing points in the West, worthy of the name, are Chicago and St. Louis. Now Kansas City was so well satisfied with its career in this direction that it passed the matter by without comment; well knowing the profound ignorance prevalent in the East about Western affairs. But Minneapolis and St. Paul became testy at once, and, assured the effete East in the most solemn manner that they could be found on the map by a very cursory examination. The *Century* published the letter of correction good-humored-

ly, and thus what threatened to be a serious complication has been peaceably averted.

Dr. W. G. Thompson in the *Popular Science Monthly* for September tells a rather apocryphal story of the West, *apropos* of the universal interest taken in the germ theory. He says: "The germ appeals to the average mind: it is something tangible; it may be hunted down, captured, colored, and looked at through a microscope, and then, in all its varieties, it can be held directly responsible for so much damage. There is scarcely a farmer in the country who has not read of the germ-theory. A cow-boy in Arizona was shot dead in the saddle recently, by a comrade, for the insult implied by calling him a 'd——d microbe' !"

The appearance of the Review this month is the natural result of the encouragement extended to it. The good will and interest manifested by the public in its success will, if continued, enable us to publish a magazine worthy of Kansas City and of the times. Its late issue is attributable to a "lost car" which contained the paper manufactured for it, and which was not "found" till almost three weeks from the date of billing the paper.

Through an error, the article in the last number of the Review on "Intellectual Love" was credited to Frederick Harrison; the author's name is Frederick Hartman, and he does not relish being translated, *nolens volens*, into a follower of Aguste Comte.

CORRESPONDENCE.

THE FATUITY OF STRIKES.

To the Editors of the Review:

There is a spirit now rife in this country which presents an aspect so hostile and menacing to our national prosperity that we cannot afford to permit it to gather strength with impunity. It is a spirit that is totally opposed to all political virtues; that destroys patriotism and converts submission to law into hypocritical appearances; that places above the duties of citizens, and the laws of the land the sanctions of secret conclaves and the commands of mysterious magnates. There is something radically wrong with any movement which disregards the laws, or finds them in the way of its purposes; that surrounds its proceedings with mystery and seeks to gain its ends by secret codes and inquisitions. Such a movement would seem to have little to recommend it to the prosperous and intelligent; but there are so many specious claims advanced in its favor and such desire on the part of the American people to do justice to the oppressed, that the greatest wonder is that we don't all become strikers on the least occasion. For there is no doubt that labor has many just causes of complaint against organized capital. When a rail-road corporation seeks to realize from $20,000,000 worth of property an income quite adequate for double that investment by watering its stock fifty per cent, the laborer may be pardoned for feeling exasperated when his wages

are reduced to accomplish this. But because defective laws permit such an outrage is it sensible or politic or virtuous for the laborer to expatriate himself—to show but a seeming obedience to the laws of his country while he follows blindly the dictates of his secret leaders? Because the rich do wrong must the poor follow suit? It has been frequently said that the virtue of a nation could be found alone amongst its humblest citizens; and it would be an unpleasing reflection to conclude that the lust for gold has corrupted all, rich and poor, high and low, alike.

There is another feature of this question which affects more nearly the laborer than he is likely to believe. It is a fact that when an individual gathers a little property together, he grows conservative, less inclined to applaud the lurid oratory of popular agitators. He has something at stake in the community, something for which he desires the protection of equal laws. When trouble comes, when the frenzy of riot and ravage sway the mob, such a man may be found at his post in the militia or in some other way testifying his respect for order.

The mechanic whose thrift and economy have given him a start on the road to competence is poor material for the labor agitator to approach; such advisers are better listened to by a mob like the one recently gathered in Chicago which announced so pathetically that "our children are crying for bread" while it emptied three hundred casks of beer. The man who drinks a glass of beer while his child is starving generally is a fair type of those who organize labor associations and live without labor from the hard wrung contributions of their dupes.

No other class is more hostile to the spirit referred to than the farmer. He cannot afford to have the business of the world stopped for a day. Every obstruction thrown in the path of commerce reacts on the farmer disastrously; and he would not willingly see its avenues closed by the acts of misguided, desperate and unthrifty men, especially when those acts are performed in open defiance of law and at the behest of unknown authorities. The farmer, more than any other citizen, needs the protection of law; and he will never wink at proceedings which savor of a new reign of terror and a later Jacobitism.

It is apparent from the nature of the case that the laborer is throwing away the sympathy and support of just the classes upon whom he must depend for help in extremity. If the present course of the Knights of Labor, and other organizations with similar high-sounding names, is pursued to its logical and inevitable conclusions, many of us will live to see the day when cordons of soldiers will replace the present unobtrusive executors of the law and every manufacturing town will have its garrison to enforce peace and order with the bayonet. This would be a sorry result for a land which promised so much liberty; which trusts so much to the intelligence of its citizens.

But "desperate diseases require desperate remedies;" if the ulcer on the body politic will not yield to compress, or plaster, the cantery or the knife are the only resources left.

C. H. D.

PHRENOLOGY DEFENDED.

NEW YORK, AUG. 29, 1885.

MESSRS. EDITORS:

Your correspondent, Dr. Browning, can be acquainted with the affairs of the Fowler & Wells Co., and with the *Phrenological Journal*, etc., but in a small degree, as Mr. O. S. Fowler has had no editorial connection with the *P. J.*, and no practical interest in the concern for upward of thirty years. He in fact, withdrew from the old firm in 1855; and since that time has published books on his own account. As regards our estimate of authority, besides personal observation, we regard the general drift of neurological conclusion to be favorable to the opinions held by Dr. Spurzheim and George and Andrew Combe. Dr. Browning has mentioned Prof. Caldwell in terms of respect, and we cannot except him from the roll of great Phrenologists. One who has read our magazine during the past fifteen years will testify to the fact that the whole field of modern neurology has been represented, and the most recent developements in pathology and experiment have been noted. There are some who have chosen the pursuit of lecturer, and gained reputation and money, but who contribute little to scientific progress. Such men may be acceptable to a large class of people, but you know, gentlemen, that their opinions are not always approved by those who are in the advance.

H. S. DRAYTON,
Ed. Phren. Jour. and Sci. of H.

SCIENTIFIC AND INDUSTRIAL NOTES.

APICULTURE.

An apicultural station has recently been established at Aurora, Ill., in connection with the Entomological Division of the Department of Agriculture. Mr. Nelson W. McLean has been appointed to take charge of the station, and Prof. Riley has instructed him to pay particular attention to the following subjects:

1st. To secure the introduction and domestication of such races of bees as are reported to possess desirable traits and characteristics; to test the claims of such races of bees as to excellence and to prove by experiments their value to the apiculturists of the United States and their adaption to our climate and honey producing flora.

2nd. To make experiments in the crossing and mingling of races already introduced, and such as may hereafter be imported, and by proper application of the laws of breeding endeavor to secure the type or types best adapted by habit and constitution to the uses of practical bee keepers in the United States.

3rd. To make experiments in the methods of artificial fertilization, and if possible demonstrate the best process by which the same may be accomplished.

4th. To test the various methods of preparing bees for winter—such as stimulating late breeding, removing the pollen from the hive in winter, feeding on sugar syrup, watering during long confinement, the stimulating of early breeding in the spring, the control of the swarming impulse and the prevention of swarming.

5th. To gather statistics concerning the bee-keeping industry in the United States, and obtain an approximate estimate of the number of colonies of bees kept, the number of pounds of wax and honey produced in the several states in the United States, and the value of the same.

6th. To make experiments with and observations concerning varieties of honey producing plants for bee-forage.

7th. To study the true cause or causes of diseases yet imperfectly understood and the best methods of preventing or curing such diseases.

8th. To obtain incontestible results by intelligent experiments upon scientific methods as to the capacity of bees, under exceptional circumstances, to injure fruit; i. e. to set at rest the ever discussed question of bees vs. fruit.

ORNITHOLOGY.

In response to a Memorial presented to Congress by the American Ornithologists' Uunion, and through the efforts of others interested in the subject, a branch of Economic Ornithology has been established under the Division of Entomology of the Department of Agrciulture; and Dr. C. Hart Merriam has been appointed as Ornithological Agent to take charge of this Divisional work.

The scope of investigation will cover the entire field of the inter-relation of birds and agriculture, particularly from the entomological stand-point. The inquiry will relate primarily to the food-habits of birds, but will include also the collection of data bearing on migration and geographical distribution of North American species. In this last inquiry the Department hopes to have the co-operation of the American Ornithologists' Union, Dr. Merriam being Chairman of the Committee on Migrations of said Union. The co-operation of farmers is solicited, and those having knowledge of food habits which are beneficial or detrimental to agricultural or horticultural interests are requested to communicate the same to Dr. Merriam.

The assistance of persons willing to aid in the collection of birds' stomachs is particularly desired.

Information is also wanted concerning the presence and habits of the so-called "English Sparrow" (Passer domesticus) in the Southern States and in the region west of the Mississippi.

Dr. Merriam will have his headquarters at Sing Sing, N. Y., until October 1, 1885, and after that date at the Department of Agriculture, and should be addressed accordingly.

ASTRONOMICAL NOTES.

A NEW COMET.

A telegram received at Harvard College Observatory, on September 1, from Prof. Swift, of Rochester, announced the discovery of a suspicious object by Mr. W. R. Brooks, of Phelps, N. Y., and requested verification of the same. The rough position sent was R. A. 13h. 20m., Decl. -|-37o.

The evening of September 1 was cloudy at Cambridge, and the comet was not seen. September 2, Prof. E. C. Pickering found the comet, and the following approximate position was circulated by telegram and cable last night:

September 2d, 9h. R. A. 13h. 42m. Decl. -|-36o 37 min.

Daily motion in R. A.—3m. 12s., in Decl. -|-18 min.

The comet is of about 9th magnitude, with circular nebulosity 2 min. in diameter, some central condensation and no tail.

VARIATION IN THE NEBULA OF ANDROMEDA.

A cable message, received September 1 from Dr. A. Krueger, of Kiel, announces a variation in the great nebula of Andromeda, which was seen by Dr. E. Hartwig, a bright, star-like nucleus having been developed. The phenomenon was observed September 1 by W. H. Numsem, of Baltimore, and on September 2 by Prof. Pickering at Cambridge, the latter of whom secured a series of spectroscopic and photographic results.

ASTEROID PETERS (249).

A telegram received at Harvard College Observatory, on August 17., announces the discovery, by C. H. F. Peters, Clinton, N. Y., of an asteroid of the 12th magnitude. The discovery position is as follows:

August 16d. 14h. 40m. Wash. M. T. R. A. 21h· 58m, 40s. Decl. —15o 51min.

Daily motion, 60s. and on parallel.

PLATINUM.

The principal portion, or, in fact, nearly all the platinum used in this country, comes from the famous mines of the Demidoff family who have the monopoly of the production in Russia. It is all refined and made into sheets of various thicknesses and into wire of certain commercial sizes. At one time it was coined in Russia, but it is no longer applied to that use. We have obtained some very good crude platinum ore from South America and have refined it successfully, but the supply from that source is very small.

A popular error respecting platinum is that its intrinsic value is the same as gold. At one time it did approximate to gold in value but never quite reached it, and is now only worth $8 to $12 an ounce, according to the work expended upon it in getting it into required forms and the amount of alloy it contains. The alloy used for it is iridium, which hardens it, and the more iridium it contains the more difficult it is to work, and consequently the more expensive. When pure, platinum is soft as silver, but by the addition of iridium it becomes the hardest of metals. The greatest difficulty in manipulating platinum is its excessive resistance to heat. A temperature that will make steel run like water and melt down fire clay has absolutely no effect upon it. You may put a piece of platinum wire no thicker than a human hair into a blast furnace where ingots of steel are melting down all around it, and the bit of wire will come out absolutely unchanged, as if it had been in an ice box all the time. No means have been discovered for accurately determining the melting temperature of platinum, but it must be enormous. And yet, if you put a piece of lead into a crucible with the platinum, both melt down together, at the low temperature that fuses lead, and if you try to melt lead in a platinum crucible, you will find that as soon as the lead melts the platinum with which it comes in contact also melts and your crucible is destroyed.

A distinguishing characteristic of platinum is its extreme ductility. A wire can be made from it finer than from any other metal. A sample is shown, gauge of which is only one two-thousandth of an inch, and it is practicable to make it thinner. It has even been affirmed that platinum wire has been made so fine as to be invisible to the naked eye.

The draw plates, by which these fine wires are made are sapphires and rubies. You may fancy how delicate must be the work of making holes of such exceeding smallness to accurate guage, too, in those very hard stones,

But delicate as is the work of boring the holes, there is something still more delicate in the process that produces such fine wire as this. That something is the fitting of a long point on the wire to enable the poking of the end of it through the draw plate so that it can be caught by the nippers. Imagine yourself fitting a long tapering point on the end of a wire only one eighteen-hundreth of an inch in diameter, in order to get it through a draw plate that will bring it down to one two-thousandth.—Mining Review.

JAPANESE TECHNICAL APPARATUS.

The question of providing instruction in physical science in technical schools without costly apparatus was recently the subject of discussion before the Society of Arts in London, and an illustration of how this might be done was given from the work done by Prof. Gutherie, at South Kensington. The subject is referred to again in the issue of the Journal of the society for the 26th ult., in which an interesting account is given of the progress made by the Japanese technical schools in providing inexpensive appliances. The Journal says: "The Tokio school trains teachers to be sent to poor villages, where a collection of apparatus such as still in this country is regarded as a benefiting equipment for a labratory would be out of the question. Hence we see bamboo canes, corks, scraps of wire, old bottles, broken tools, flower-pots, in short things that in every village would go to the rubbish-heap, utilized for the construction of apparatus. To those who have not seen in the South Kensington museum what Prof.

Gutherie's pupils have done, it would appear almost incredible what those Japanese can do. They do not come up to the South Kensington work in point of finish and elegance, but this is not aimed at. To find the handiest material for doing just what is wanted is the point. No doubt the specimens exhibited in the country are picked, it is natural that they should be so, still they are representative. What simpler material for the construction of an electric machine could be thought of than two old beer bottles, one for the cylinder and the other as an insulating stand, a fragment of an old saw, an old bell, some long sharp nails driven in a row, some old handles and other bits of wood? Or, again, for a mercural air-pump, some short lengths of glass tubing, bottles, a tumbler, sealing-wax, string and caoutchouc? Yet, somewhat clumsy though it looks to our eyes, accustomed to delicate and finished instruments, it illustrates the manner of its acting, even if it should not be capable of working with great perfection. Then there is a simple polariscope, a Coulomb's torsion balance, and a Cartesian diver, consisting of an eggshell, a small stone, a bottle and cover. A model to illustrate the principle of an equatorial telescope is especially simple. It belongs to another section, but illustrates simplicity. Into the cork of a bottle is put a short piece of wire, on to which is placed another cork. From this springs another wire, on to which a soft wax candle is pushed. Why a bamboo cane is not used instead of a wax candle is not apparent, but the principle is the same,

For chemistry the arrangments are just as simple, A retort stand is made from bamboo, a piece of wire-work ash-sifter for the retort to rest on, and a strip of bent bamboo to form a clip. Where bamboo cane can be used instead of glass, it appears to be done; for example, in place of a glass jar with a nozzle for burning hydrogen, a large hollow cane, stopped at one end with a tobacco mouth-piece, is used. Thus, perhaps, it is really hardly so simple, though, as the usual way of generating the hydrogen in the same bottle as that from which it was burned. Stoneware jars, however, seem in all cases used as retorts, for no glass retort is shown. Teachers often say they cannot show their pupils the decomposition of water; but here is a Buren battery —one 'cell' at least—made of a glazed pot, a porous pot, a coil of zinc and a stick of charcoal. The 'collector' is equally home made, except that the two test tubes probably have to be purchased, and these are cheap enough, it is in the putting together the skill lies."

PENETRATION OF LIGHT IN WATER.

Experiments have recently been conducted in the Lake of Geneva and elsewhere by M. M. Fol and Sarasin to determine the depth to which light penetrates in its waters. The method of experimenting was to submerge photographic plates of gelatine bromide of silver at various depths and develop the luminous images produced on them by rays penetrating from the surface. A coating of bituminous varnish, easily removable by alcohol or spirits of turpentine, served to guard the sensitive layer from the chemical action of the sea water. The rays affected the sensitive surface through a layer or back plate of glass. Oxalate of iron was employed as the developer, allowed to act for ten minutes. In clear sunlight during March and near Ville-franche-sur-Mer, they obtained images to the depth of about 400 meters. The images increased in strength as the depth diminished. In the Lake of Geneva they, however, only obtained images to the depth of about 200 meters, or half as far; and the authors conclude that in winter months sunlight does not penetrate farther than 200 meters, while in the Mediterranean it stops at about 400 meters deep.

COMMERCIAL VALUE OF THE EUCALYPTUS TREE.

The eucalyptus tree has been domesticated in Mexico with considerable success. It could hardly flourish better even in its native soil in Aurtralia. Naturalists are surprised when they behold the giant trees in the Zocalo and other portions of the city

and learn that they are but a little over sixteen years old, for their size leads them to suppose they had grown twice that number of years. The wonderfully rapid growth, the hardness and durability of the wood, with its value for a wide variety of mechanical purposes and for fuel, and the sanitary qualities of the tree as a preventative of malarial disease where it is planted, make the eucalyptus one of the most valuable gifts contributed by one country to the flora of the world. Extensive forests of it are growing in Italy, in North America, in California, and in other countries where the climate permits its culture. In California its cultivation yields greater profits than are afforded by the vineyards; grape-raising being one of the most profitable industries of that flourishing state. It is valuable as timber for all sorts of mechanical purposes. For railway construction and maintenance it would be of great worth.

FORMATION OF COAL.

There is in Phœnixville, Chester county, Pa., an exemplification of the operations of nature as displayed in the formations of coal, where it can be found in actual process of transformation from vegetable matter to a soft, soapy carbonic substance, and the latter gradually changing to lignite and then again into the soft coal of the bituminous form. Go along the Pennsylvania Schuykill Valley railroad, between the first passenger station of that system and the new one, and you will find a force of men cutting down the bank there, 18 or 20 feet high, and amid those rocks, perhaps 3 feet above the railroad track you will observe a black seam. The black seam is a laboratory of nature. From above, before the Morgan house was removed and the surrounding bank, big trees sent their roots down through the crevices of the rock till they reached the seam in question, which, in time, they filed with roots and fibres. The trees above died and the roots and fibres confined in the seam began to work, chemical changes took place, carbon was evolved and coal was the result. The labratory was opened by the building of the railroad before the slow process was fully completed, so that you can find there to-day the vegetable and carbonized matter and lignite and coal all together, proving, indeed, the popular thought that coal grows is true.

ASSYRIAN COLORS.

The colors which have revealed themselves during Layard's excavations at Nineveh, Wm. Linton says in the Architect, display sufficient evidence that they are not inferior to those of the ancient Egyptians, either in number, variety or brilliancy. Instead of the common earthy bole or reddle of the latter people, the Assyrians have left us a color almost equal to vermilion itself. The monochrome pictures which represented the chaldremes on the wall (Ezekiel xxiii 14,) are said by Gesenuius, the Septuaguint, and the vulgate, to have been painted by sinoper or rubica, a native earthy oxide, like Indian red; while both the great English versions of the Bible now in use, as the rabbis, translate the word at issue ("shashar," Jeremiah xxii, 14,) vermilion. At Khorsabad it appears that the red approached in hue to that brilliant color, while the sculptures at Nimroud exhibited a bright crimson or lake tint. Layard thinks there is no doubt of their having made great use of vegetable colors; the materials of which are so plenteous in the vicinity of Nineveh. The rapid evanescence of some specimens of blue and red on plaster which were bright and perfect in color when first exposed, would appear to favor a vegetable origin, as no susceptibility of the kind is known to characterize any mineral reds or blues with which we are at present acquainted. Layard claims for the older Assyrian period the same colors which have been attributed to the early times of the Egyptians, viz., blue, red, yellow, black and white. He also speaks of a green on the earlier monuments of Nimroud, and of green, purple, violet, brown, etc., enameled in paintings of figures on bricks at the northwest palace. In allusion to the analysis of Sir Gardner Wilkinson's specimens of the Alexandrian blue, by Dr. Ure, Layard conjectures that the coloring principle may

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be the same, but affirms that the Assyrian blue is much the brighter. He concludes that the color was derived from copper, as he found an old mine of that ore in the neighborhood of Nineveh. Layard considers the greens of Assyria to be similar to those of Egypt, which are in many instances composed of iron ochre and copper blue. The yellows and blacks also he conceives to resemble those from Egypt; and as specimens of the latter class of pigments he mentions calcined bone and black iron ochre. The whites are of alabaster and gypsum. At Khorsabad the French antiquarian, M. Botts, found green, red, black, white, yellow and blue—the latter very lively in color.

THE ORIGIN OF THE RAT.

The origin of the rat, like the birth of Jeames Yellowplush, is wrapped up in mystery. The ancients, according to a learned writer, quoted by M. Eugene Roland in his "Faune Sauvage," knew not the rat. Their condition was more gracious. But it is hard to be certain about the fauna of the ancients. When they use a word meaning mouse they may have had field mouse or common mouse or perhaps even the rat in their minds. Herodotus tells, on Egyptian authority, the same tale of an army defeated by mice who gnawed their bowstrings as the Creek Indians tell of rats in their cosmogonic legend. This legend was fairly written in red, on a skin, and was kept during the last century in the Georgia office. Where is it now?

The Chinese have precisely the same story only they, like the Creek Indians, assign the victory to rats, not to the mice of the old Halicarnassian. Perhaps Herodotus meant rats, he knew nothing of cats till he went to Egypt, and about rats he may have been equally in the dark. Rats are not uncommon in Shakespeare, but Buckland says Genner (1587) first mentions the black rat. This, though older than the brown rat, is not apparently aboriginal. The Welsh name for rat means "French mouse," and perhaps the rat, came over with the Conqueror. An accomplished author on micromamologie thinks the rat was brought to Europe (involuntarily, no doubt) by the Crusaders. The brown or so-called "Norway rats," devour the black ones, and are later comers.

If a well known character was really "a rat in Pythagoras' time," the argument against rats being known to the ancients falls to the ground, and Shakespeare certainly thought that rats were common in the heroic age of Denmark. Rats in the zoological gardens are a good deal to be pitied. We all know the elephant of the fable. She one day trod unwittingly on a partridge, and killed it. Soon afterwards she found the nestlings of the partridge. "Poor little things!" said the elephant; "I, too, have been a mother;" and, with the kindest intentions, she sat down on the nest. In the same way the rhinoceros, never dreaming of harm, lies down on rats in his house, and compresses them quite flat. Such is their doom—an example, as far as it goes, of the ruthless laws of nature, and the survival of the fittest. The instinct of rats teaches them to shun a falling house; but not, alas! to avoid a sleepy rhinoceros.

COAL IN MEXICO.

A few years ago, in discussing the future of Mexico, it was no uncommon thing to find the leading journals of the country indicating that the advancement of Mexico must ever be retarded from the lack of coal within its borders. It was stated positively that it was practically without coal, and that none had ever been discovered which could be utilized. More recent investigation and a better knowledge of the facts show that Mexico has an ample supply of coal for all purposes, and it would not be surprising if its resources in this direction should be found sufficient to revolutionize the coal trade particulary of the Pacific coast.

A recent investigation of the coal trade in Sonora shows that a large anthracite coal field there exists, extending continuously from the summit of the Las Bronces range of mountains to the Yagui river, that contains 108 square miles more than the five

anthracite basins of Pennsylvania and is as great as the aggregate area of all the coal field of England. It is claimed, also, that this coal is superior to the anthracite of Pennsylvania, having from 90 to 92 per cent. carbon, to 3½ to 5 per cent. waste, and leaves no clinkers when burned. In many places the workable seams exposed by erosion and meteoric agencies are from four to five feet thick; some ten, and others sixteen feet of excellent coal. What is true in regard to Sonora will probably be found duplicated in every other portion of this great country, the resources of which as yet are practically unknown. It is stated that English capital has already large interests in the coal fields of Sonora, and preparations are being made to build railroads and to otherwise utilize the immense treasures here discovered.

THE FIRST ATLANTIC CABLE.

Mr. Cyrus W. Field, celebrated the 27th anniversary of the laying of the first Atlantic cable, lately, by a complimentary dinner to about two hundred distinguished personages, at the Star and Garter Hotel, Richmond (England). Mr. Field presided, and amongst those who were present, we notice the names of Sir Lyon Playfair, M. P., Mr. G. Shaw-Lefvre, M. P.; Sir William Thomson, Sir Charles Bright, Sir James Anderson, Sir Henry Thomson, Sir George Elliott, M. P.; Sir Daniel Gooch, M. P.; Sir Julian Goldsmid, M. P.; Sir Arthur Otway, M. P.; Vice Admiral Sir George Richards, M. P.; Mr. George Renter, and many others. The loyal toasts, English and American, having been honored, the chairman gave "Success to the Atlantic cables; may they perpetuate the peace, friendship, and prosperity of two great kindred nations." He gave in brief terms, the history of the difficulties encountered in laying the first cable, and described the success eventually achieved. They had covered both earth and sea with a subtle and instantaneous means of inter-communication, which was destined, in its far reaching consequences, to bind together all the great English speaking family, and to play an important part in advancing the general well being and progress of mankind. Senator Hawley of Connecticut, Sir George Elliott, and Sir James Anderson responded; after which the chairman proposed the toast of "The men of science and enterprise to whom sub-marine telegraphy is so largely indebted," coupling with the toast the names of Sir William Thompson, and Sir Charles Bright. The "health of the chairman," proposed by the Lord Mayor, brought the proceedings to a close.

A PACIFIC OCEAN CABLE.

The following curious remarks are from the pen of the San Francisco correspondent of the Electrician and Electrical Enquirer of New York. What a boon to commerce, and what a course of general satisfaction to the reading people of the world would a cable from the Pacific coast to China be; say along the 40th parallel to the Japenese Islands and Shanghai. In this way we could have pure and unadulterated war news, which must now be taken with considerable allowance after passing through the sieve of a British censorship. This cable was contemplated some eight or nine years ago, and the United States steamer Hassler took soundings, but because it did not promise an abundant return for the money to be expended, it was allowed to drop. In a few years when Russia will control the Persian Gulf and the Sea of Oman, she may unite with China in establishing direct cable communication with the western hemisphere; unless England forestalls her by connecting Victoria B. C. with Yeddo Japan. England very seldom unites with other countries in promoting any scheme for the public good unless she is to derive the greatest benefit therefrom.

A CEDAR GROWING FROM AN OAK.

Mr. J. Brundage, sends from Challenge Mill, Yuba county, to the Sacramento Record-Union, a photograph taken by him of a singular growth. It represents a mountain oak, two feet in diameter at the ground and fifteen feet in height, at a point where it appears, at some time quite remote, to have been broken off. Each side of this

break, which evidently left a cup-like in dentation, grows out on one side and up on the other limbs bearing the usual foliage. But from the point of the supposed break rises out of the oak, and growing firmly from it, a cedar tree, which is about thirteen inches in diameter, and rises straight as any arrow between twenty-five and thirty feet. It is as shapely and handsome a cedar as one could wish to see. It is situated about three miles from Challenge Mills, and is in the high Sierras. It is a remarkable curiosity, and is so regarded by all who visit it. Whether the cedar grows after the manner of a graft, or whether it has a tap root extending down through the oak, are questions to be determined. Only one instance recalled of a similar growth is in the Calaveras grove of big trees, where some years ago was seen a small sugar pine growing out of the fork formed at a great height by a limb and the trunk of the giant sequoias. Evidently the sugar pine seed, being there lodged, found sustenance sufficient after germination to feed the pine growth.

A FIRE-PROOF SUIT.

A man in a helmet suit set fire to a house at Oak Point Tuesday evening, says the New York Herald, and going amid the flames cooked a steak upon a burning window sill, and, sprinkling it with red pepper, ate it without a sneeze. Thirty gallons of petroleum had been sprinkled over the inside building, and when this ignited the heat became so intense as to drive the spectators away into the shade. There were no terrors in this for the incased individual however, for he threw away his dishes, and resting himself upon a crackling stool opened a bottle of wine, and lighting a cigar, drank and smoked until his table, stool and wine, and cigar were all consumed. There was an opening in the face of the helmet, through which the inner man was refreshed and after these diversions the opening was closed, and with a yawn the man lay upon the floor with a seething log for a pillow and proceeded to take a nap. But there was too much excitement outside to allow of quiet, undisturbed slumber, and arising with a petulant air the would-be sleeper seized a fire brand and darted forth to drive his tormentors away. The man is a native of Sweden, named Ahlstom. He invented the suit, the outside of which is made of mole skin and the inside of rubber. A small hose is used to fill the space between the parts with water; and another hose supplies the man with air from outside the burning building. The act is merely curious, not of practical value.

A THINKING MACHINE.

A cultivated gentleman of French descent residing in Gallipolis, Ohio, who has been an invalid for several years, has just received a patent for an invention of more than ordinary merit and of a peculiar character. It excites the wonder and admiration of all who behold it. Many declare it the equal, in general untility, of the sewing machine or telephone. It is perfectly wonderful in its operation, and yet so simple in its action that a child can learn to use it in a few minutes. It consists of a pair of scales which announce with unerring accuracy the value of any number of tons, pounds or ounces at any price. For instance, a ham is placed on the scales. Its weight is twelve and three-quarter pounds, and the price is 12½ cents per pound. A sliding weight is moved along the scale beam until the ham is balanced. In the notch where this weight stops will be found the worth of the meat in dollars and cents to a fraction. Again, suppose a grocer is asked for 50 cents worth of tea. The price is 78 cents. One indicator is set at fifty, the amount wanted, the other at seventy-eight, the price of the tea. Tea is poured into the scoop until the scale is balanced, when the quantity of tea is found to be correct as if several minutes time had been consumed in making the calculation.

A MONSTER GLOBE.

Detailed accounts are given in the Berlin and Paris papers of a monster movable globe made of copper, the work of a blind clockmaker, and on the construction of which seventeen years were spent. The globe

represents the earth, and like it, turns on its own axis by means of a mechanism; an artificial moon moves round the Globe in twenty-eight days and six hours, while a movable metal band on which the hours are marked indicates the mean time in the different parts of the earth. Round the upper portion of this immense globe, which weighs a ton and a half, and whose surface measures 126 feet in diameter, spins a railroad car capable of holding six persons, and which serves to give a better view of the regions of the North Pole. The painting of the globe is done in oil, and necessitated the employment of two men during an entire year. The sun is represented by an intense Drummond calcium light, which enables the spectator to watch intelligently the origin and change of the different periods of the day, the early dawn, the twilight, eclipses of the sun and moon, etc.

AMERICAN EXHIBITION AT ROME.

A permanent exhibition of United States products will be opened at Rome, Italy, on November 1st of the present year.

Rejuvenated Italy is a non-manufacturing country with a population of 30,000,000, and the value of its yearly imports is about $260,000,000. The density of population, it will be readily understood, is of advantage to exporters in more than one way; and its almost insular position places its chief markets in easy communication by sea with the rest of the world. To the American exporter the country presents a population equal to that of all the South American states, and confined to a territory of comparatively small proportions and easily reached at nearly all points. In addition to this, a comparison of its imports with those of the countries to the south of us show that they equal those of Mexico and all the Central and South American states considered together.

The exhibition is projected by some of the most prominent Italians, and will be conducted under the auspices of the Italian government and the United States Consul-General. It will have forty-one branches in the different Italian cities, and its getters-up and managers promise to do all in their power to encourage trade between the two great Nations. The permanent exhibition is to be free to all, and only such goods are invited as are apt to find a sale or to meet a want in Italy or the Mediteranean ports. The charge to exhibitors is only $15 for twelve months, an exceedingly reasonable amount, especially when it is considered that the exhibition company takes full charge of the exhibit on its arrival in Rome.

THE PURCHASING POWER OF A DOLLAR.

The Boston Commercial Bulletin compares the purchasing power of a dollar in 1885 with that of the same unit of value in 1875, '55, '45 and '25. In doing so it takes the average wholesale prices of fourteen leading commodities, viz: wheat, corn, coal, iron, salt, pork, beef, rice, sugar, butter, cheese, cotton, wool and leather. First, the price of these as per fixed quantity are given, that is to say, wheat is quoted by the bushel, corn and salt by the sack, coal and iron by the ton, pork and beef by the barrel, and the rest by the pound. The result of the comparisons is to show that in the half of a century between 1825 and 1885, wheat advanced 11 cents, beef $1.50, rice 1¼ cents and butter 3 cents. Pork suffered the least, losing only 30 cents per barrel, while coal declined from $9.50 to $3.85, iron from $55 to $18, and salt from $2.60 to 85 cents. But the more interesting table is that in which the Bulletin presents for comparison such quantities of each commodity as, at market quotations in 1825, would be worth $55 or about that amount. It is given below, and will be well worthy of careful examination:

	1825.	1845.	1855.	1875.	1885.
Iron, per ton....	$55 00	$ 4 00	$ 31 75	$35 00	$18 00
Wheat, 60 bushels	54 60	67 20	142 80	68 40	61 20
Corn, 95 bushels.	55 10	61 75	103 80	59 85	50 35
Coal. 6 tons.....	57 00	21 50	39 00	29 82	23 10
Salt, 20¼ sacks...	54 94	28 70	21 73	43 75	17 42
Pork, 4 barrels...	53 20	45 60	71 00	81 48	52 00
Beef, 6 barrels...	54 00	45 00	67 50	54 00	63 00
Rice, 1,833 lbs....	55 00	67 21	76 37	137 47	96 25
Sugar, raw 650 lbs	55 50	32 50	39 00	32 50	22 50
Cutter, 366 lbs....	54 90	27 45	82 35	82 35	65 88
Cheese, 740 lbs...	55 00	51 80	66 60	92 55	44 40
Cotton, 275 lbs...	55 00	17 87	24 75	40 25	30 25
Wool, 275 lbs.....	55 40	43 20	48 00	68 80	46 40
Leather, 230 lbs..	55 20	39 00	52 80	57 60	55 20
Average.....	$54 90	$42 93	$61 96	$63 13	$46 85

INDESTRUCTIBILITY OF GOLD.

Sir Henry Vivian: Gold may be said to be everlasting, indestructible. The pure acids have no effect upon it. Air and water are alike prohibited from working in destruction; while to baser metals they are decay, to gold they are inoculous. Bury it through long ages, and when the rude tool of the excavator again brings it to light, while everything around it, and originally associated with it, has returned to dust from which it sprang; while the delicate form which it adorned has become a power so impalpable as to be inappreciable; while the strong bone of the mighty warrior crumbles as you gaze upon it; while his trusty sword lies a mass of shale rust, the delicate tracery in gold which adorned it or the finely wrought tiara which encircled the lofty brow of the fair damsel, is there in its pristine beauty, perfect as when it left the workman's hands and became the joy of the fleeting moments. Yes, days, years, centuries have rolled by; mighty empires have risen and fallen; dynasties that dreamed their power was to be everlasting have passed away; armies have marched, conquered, and become nerveless with decrepit old age; cities teeming with population and commerce have become the dwelling place of the owl and the bat; the very pyramids themselves, raised in the pride of power, and destined to be forever, have crumbled, and are crumbling, and yet that thin filament of gold has stood unchanged through all these mighty changes. It has withstood triumphantly the destroying hand of time; it is to-day what it was three thousand years ago. Surely it is a noble metal worthy of all admiration.

BARTHOLDI'S "LIBERTY."

In connection with the scheme for providing a pedestal for the colossal statue of "Liberty" presented to the American nation by France, the New York (N. J.) Journal has on exhibition at its office an exact reproduction of Bartholdi's great work, in bronze, standing upon a handsome mahogany case containing an electric attachment. When a quarter of a dollar is dropped into the aperture at the base of the statue, a cam inside revolves, depositing the coin in a locked drawer below. At the same moment the cam presses a spring, which completes an electric circuit between a set of Bunsen cells beneath, and a minute Edison incandescent lamp which Miss Liberty holds aloft in lieu of a torch. The torch flashes its tiny light for a moment at every coin that enters the drawer.

A NEW FIBRE.

Some time since the Two Republics noted the discovery in Nuevo Leon of a new fibre resembling flax. Since then a Laredo capitalist who discovered it has been forming a company to develop the fibre on a large scale. Speaking of this discovery to the representatives of this journal, he says the plant is found in abundance in the arid lands of Nuevo Leon, and seems to flourish on a rocky, desert soil, which is unserviceable for other products. Reproduced in good soil and cultivated, it will grow very rapidly, reaching a height from two to five feet. The shoots are of different thicknesses, all having abundant fibre, which is beautiful in appearance, solid, strong, and easily drawn out even by hand from the shoot. It is a straw color, but easily bleached. The fibre is finer and stronger than flax.—[Two Republics, City of Mexico.

A curious thing about the excavation of the ruins of the Atrium Vestæ, at Rome, was the discovery of a number of Anglo-Saxon coins, dating from 901 to 946. How did these foreign pieces happen to get dropped in the heart of the Eternal City? This puzzle is rather more difficult than that involved in the finding of pieces of Roman money in every part of Europe. But the number of ancient Roman coins dug up here and there is astonishing. A few years ago borings on the brink of some rather well-known hot springs in the east of France brought to light no fewer than 4,700 Roman coins. Four of these were gold coins of Nero, Hadrian, Faustina, Jr., and Honorius; 265 were silver coins, principally of Imperial and consular types, associated with a few Gaulish coins. Of bronze there were as

many as 4,468—large, middle and small brass—ranging over a considerable period. With the coins were associated other objects, such as statuettes, pins and rings, in bronze, gold, lead and iron. What does this mean? Simply that well-to-do Romans were quite as much in the habit of resorting to thermal springs for pleasure and profit as millionaires of our own day,

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Well may we doubt the success of the alchemists of old in their search for the "elixir of life," but if the views published in England by Mr. W. O. Dawson are correct, modern science at least appears to be able to retard the progress of old age. Mr. Dawson tells us that the changes which produce old age are due to an excessive action of the oxygen we breathe and to accumulation of lime salts in the body. He does not state whether the oxygen effects may be in any degree counteracted, but he believes that life may be prolonged by reducing the calcarious deposits to a minimum. This he would accomplish by a plan suggested by Mr. DeLacy Evans. The plan is to avoid food containing a large proportion of earth salts—such as the meats from old animals—and to use daily, after middle life, several glasses of distilled water containing a few drops of phosphoric acid. Distilled water is necessary on account of its great solvent power.

Col. Snowden, former superintendent of the Philadelphia Mint, has perfected an invention which, it is said, will render it impossible to counterfeit United States coinage. This invention consists of a twice bisected steel collar, which when attached to the dies will form raised letters upon the peripheries of the coins. The new coin cannot be imitated by counterfeiters, because it cannot be made in a mold or by any process except the steel collar, hand engraving or a screw press. Milled coins can be lifted out of a mold without injury, because the lines upon their edges are straight up and down. The new ones have letters and stars on their edges, and cannot be taken out except by injuring them and mutilating the molds.

Paper it is said is taking the place of cedar in the making of lead pencils. A novel use for paper has been found in the manufacture of gas-pipes In addition to being absolutely tight and smooth, and much cheaper than iron, these pipes are of great strength, for when the sides are scarcely three-fifths of an inch thick, they will stand a pressure of more than 15 atmospheres. If buried under ground they will not be broken by settlement, nor when violently shaken or jarred. The material being a bad conductor of heat, the pipes do not readily freeze.

The Los Angeles Herald describes a specimen of the vampire family recently caught there: "This huge specimen measured twenty inches from tip to tip of his wings, and was pretty well armed with teeth and claws. His head was as large as the heads of four or five bat heads combined, and well hooded with two ears fully as large as a half dollar. His majesty was as vicious and war-like as a scorpion or tarantula when confined, and his bite would probably be as dangerous."

Prof. Joseph Stanley Brown, one of the geologists of the National Survey, has resigned and his resignation accepted by Secretary Lamar. Science loses in him a close observer and careful recorder of mineralogical and geological dates. He will, however, we trust, be restored to active labor as his resignation, which is entirely voluntary, is for the purpose of pursuing special scientific study at New Haven.

A Sweedish engineer has succeeded in producing a new explosive, which he calls romite. It is claimed that no elaborate machinery is required in the manufacture of this explosvie, that it will not freeze, and cannot be exploded except by ignition. Experiments have been made with the new explosive for blasting, and it has also been tried in shells, the results, it is said in both cases being entirely satisfactory.

There is a wonderful fish in Goose Lake, Oregon. It is called by some the greenback fish, for it is certainly an inflationist. It

has the power to fill itself up with air until it becomes very much like a round ball. Of evenings, about sundown, they may be seen playing on the surface of the water. They will swell up by taking in the air, and the wind will blow them over the lake They reflect all the colors of the rainbow, and when sporting over the lake are a grand sight.

Eyesight among civilized people is by no means as strong as among savages. A gentleman in Zululand, by the assistance of a powerful glass, made out two distinct objects on the horizon, which he guessed to be a mounted man with a walking companion. The Zulus with him was able at once to inform him who the gentleman was, and that he was accompanied by his wife on foot.

In 1879 only 103 fossil insects from the carboniferous rocks of the whole world were known, but during the last five years a great number have been discovered, including 1,400 from Commentry, France, a few from Saarbruck, Kleinopitz, Lugau and other Continental European mines, and a very considerable number from the mines in this country.

Late Belgian experiments have had the object of preserving wood by exhausting the air from the pores and causing liquid gutta-percha to take its place. The gutta-percha is liquefied by being heated with paraffine, and it hardens on cooling after being introduced into the wood.

According to late advices from Japan, every man of any means, and even the local officials, in the Toyama prefecture, is studying the English language. It appears to be a general belief that those who do not know the English tongue are behind the times.

A Japanese has discovered a process of making paper from seaweeds. It is thick in texture, and owing to its transparency can be substituted for glass in windows, and when colored makes an excellent imitation of stained glass.

A four-footed bird is found on the island of Marago, at the mouth of the Amazon. In time one pair of legs are changed into wings by as singular a process as that which make the tadpole a frog.

A cable message received at Harvard College Observatory, from Dr. A. Krueger, at Kiel, announces the observation, at Nice, of Tuttle's Comet, giving the following position :

August 9.6124 Gr. M. T. R. A. 7h. 23m. 43.1s. Decl. -|- 28 deg., 1 min. 24 sec.

The last word in the message, probably indicating motion (terrotin), is unintelligible.

MISCELLANY.

ROMANCES OF MINING.

So many misconceived notions are entertained about frontier mining towns and the bloodthirsty disposition of the inhabitants, writes a correspondent of the Philadelphia Press, that I have recalled from memory scenes that, while they may not counteract this belief, will, to a certain extent, show that romance and fate have a great deal to do with the promulgation of this notion. In 1867 one of the most productive mines discovered near Leadville, Col., was found by a Mr. Long, who, hungry, emaciated, and with a large old English penny in his pocket, "for luck," as he called it, went out shooting for a breakfast. A deer was his first shot; the animal died hard, struggled, kicked up the earth, and eventually subsided in a particular rocky spot. Long hastened to its side, and, instead of a dead deer, he discovered evidences of gold dust. Long informed his partner, a Mr. Derry, and they possessed themselves of the spot and became rich. That was before Leadville became what it is to-day. Hardly six months had passed, when news, rehashed, magnified

and made sensational by eastern journalists, went travelling over the country that two gamblers, notorious characters, had waylaid a party of travelers, composed of a lady and three men, assaulted them, and, killing them, found in their pockets evidence of a rich gold mine and pre-empted it. Wilbur F. Story, then in the height of his power as a journalist, had seen the story. He knew Long, examined into the truth of the tale and gave a true version of it.

The Eberhardt Silver mine was discovered in 1868, near Elko, Nevada, by a boy who was working for a gang of men cutting ties for the Central Pacific railroad, then in course of construction. Elated with his success he disclosed his secret to a man who was foreman of the gang. The foreman pre-empted it and sold it, as guardian of the boy, to an English company of capitalists, for a large sum of money. Some friends of the youth, who were Germans, became interested in the matter and found he had been defrauded out of his rightful dues, and they instituted suit against the company to test their claim. The company compromised with them for some $500,000, and another sensational story came east, was published first in Boston, of the kidnapping of a boy by bloodthirsty cowboys, who asked a ransom for him, as he was the owner of a wealthy silver mine, and what gave additional color to the matter in Massachusetts at the time was the death of an immensely wealthy gentleman, who left his entire property, amounting to millions, to his son, a minor who was missing for a few days. I believe it was through the efforts of a Mr. Bacon, a Boston journalist, that the matter was investigated and the truth proclaimed.

Some six years ago Mr. Ernest Ingersoll published in Scribner's Monthly a very long article on Leadville, and I remember he mentioned the finding of the Camp Bird mine there by the Gallagher brothers, two illiterate sons of the Emerald Isle; but as he never told how they discovered it, and the sensation it produced east subsequently, I will relate it. These Gallagher brothers, Dan and Michael, were exceptionally Irish in everything, very poor, but honest, shrewd, and to a certain extent superstitious. One day, together, they started out with a hope of getting employment, and in crossing a piece of country contiguous to the silver mine, Dan stopped to tie his brogans or army shoes.

"Oh, Mickey, here's luck!" he exclaimed, picking up a small sized silver quartz.

They both examined it and discovered it was genuine rocky quartz silver, and they possessed themselves of it. Not long after, a paper published not fifty miles from Chicago, gave a sensational account of two Irishmen, with pistols and etceteras, "jumping" a silver mine, the rightful property of an old Scotchman, the whole thing originating in the fertile brain of the writer. Dr. Wood, then on the New York Sun, had a suspicion that all was magnified, and wrote a long article to a western paper, arriving at the truth.

There has been more romance connected with early Leadville than any other place on the frontier. One of the most morgue-like stories that was ever published, was revamped from a minimum of truth into a maximum of romance. It was related to a claim called the Dead Man's Claim, discovered near Leadville. A man came from the eastern part of New York hoping to establish himself as a physician. He was talented, educated, but very delicate, entirely unfitted to stand the hardships of a frontier life, especially a winter life, when, penniless and hungry, he found himself stranded and with no shelter but that afforded by stray saloons and gambling places, for Leadville was already overrun with physicians, lawyers, and men of brain. He had a few friends among the many happy-go-lucky fellows he met, and they helped him as best they could. Suddenly he was taken sick with pneumonia and died. The poor fellows who stood by him in his sick-room were determined that he should have a decent burial, so they clubbed together and raised a purse of $50. An old miner, "dead broke," and a sort of handy man around the saloons, named Parish, was given $30 to dig the grave, and $20 for a coffin.

It was in the dead of winter, the snow five feet on the level, so the body was taken out and buried in the snow, while Parish started at his work. The two men who had collected the fund for his burial got interested in a long game of poker, and after sitting nearly forty-eight hours concluded they would hunt up Parish and find out how he was progressing. So one morning they adjourned to the spot, and there was Parish digging away for dear life. He had struck a paying mine, and forgetting all about the body, was unearthing treasures. The two friends claimed their share. Parish would not yield. Eventually the affair was compromised and sold out to advantage to a company. Later the poor doctor was buried, and the matter became a ten days' wonder and died out as far as Leadville was concerned, when one morning Parish's attention was called to a long article in a newspaper of how he and a gang of murderers had in cold blood murdered a wealthy gentleman and "jumped" his claim. The matter was the occasion of a general laugh around Leadville, and poor Parish for sometime after earned the sobriquet of the "death dealers' jumper."

GREAT GAMES OF CHESS.

In the history of the Saracens, it is said that when Al Amin, the caliph of Bagdad, was besieged in his city by his hereditary enemy, Al Muram, he was engaged in a game of chess with his freedman and attendant, Kuthan. The enemy was advancing in tremendous force upon the city gates. Terror-stricken, the courtiers rushed in to warn the caliph of his danger, but he would pay no attention to them. "Let me alone," he said; "I see a checkmate against Kuthan." This ruler was so devoted to chess that he had his kingdom searched for all the good players, and had them brought to his palace, where, whatever their rank, he made them friends, and heaped gifts upon them. Among these was the slave Kuthan, who became the caliph's favorite antagonist in the game. The case of Al Amin furnishes a by no means singular instance of the absorption of interest possible in this fascinating game. King John was at chess when the deputation at Rouen came to tell him that Philip Augustus had besieged the city, but he refused to give them an audience until the game was done. Charles I, was engaged in playing chess when the news was brought to him that the Scots were going to sell him into the hands of the English, and manifested no interest whatever in the intelligence until his game was finished. So, too, John Frederic, Elector of Saxony, when imprisoned in 1547, was beguiling the time by playing chess with a fellow-captive at the moment when a messenger came to tell him that the Emperor had sentenced him to be beheaded before Whittenberg. He betrayed no agitation at the news, but proceeded with the game, and expressed the heartiest satisfaction at the close over the fact that he had beaten his opponent. The Hindoos say that chess was the invention of an astronomer who flourished several thousand years ago, and who was possessed of supernatural knowledge and acuteness. The Greeks claim that it was the invention of Palamedes to beguile the tedium of the siege of Troy. The Arab legend is that it was devised for the instruction of a young despot by his tutor, a learned Brahmin, to teach the youth how a king was dependent upon his subjects for his safety. Oriental chess is of two kinds, Chinese and Indian chess. The Chinese game is played generally in eastern Asia; but in India and the adjacent islands, and, with some slight modifications, all over the civilized world, Indian chess is played. The bishop is the elephant in India, the castle the boat, and the queen the minister; otherwise the pieces are identical with those known to us. There is a chess school in India with its salaried professors, and success in the game is held in very high regard. Monesh Ghutuck, it was said, could play a fabulous number of games when lying on the ground with his eyes closed. The complications of the game called the Indian problem are known all over the Occident as among the most difficult ever devised. The Chinese chess-board has sixty-four squares and a broad strip

called the River Ho across the middle. The castle is known to them as the war-chariot, the bishop as the elephant, the knight as the horse, and for the king and queen they have a general and two officers. They have but five soldiers or pawns, and two cannon, the latter being able to move over the heads of the officers. The general, cannon and chariot can not pass the river. The Persians call chess Timour's game, because of the favor in which it was held by Timerlane, the great Tartar ruler who lived in the fifteenth century. This king found the game so easy that he introduced additional men and moves to complicate it. This was the origin of what is known as great chess in Persia, in contradistinction from little chess, the common game. This is played on a board with 110 squares and fifty-six men. A Persian emperor is said to have called one of his sons Sehahrohk because at the moment he received the intelligence of the infant's birth he was playing chess, and had just given check with his rohk (castle) to his adversary's king (sehah.) Kings and potentates have usually delighted in chess. Charlemange delighted in the game. So did King Canute or (Knut) the Dane. Ivan the Terrible, of Russia, died in 1584 of an apoplectic fit, caused by rage at a checkmate received from a subject. Queen Elizabeth was very fond of chess. So was Napoleon I. He opened his games badly, his biographer assures us, but when warmed up to the game he made some very brilliant moves. At St. Helena he played daily, going over on the board the battles that he had fought, and more than once declared that he ought to have won at Waterloo. Louis XII. of France was so fond of chess that he played it in his carriage.

Casimir II., King of Poland, in the twelfth century, prohibited the playing of chess in his dominions. A similar law was enacted by the Turkish Caliph Hakim, in the year 1025, punishing with the bastinado all who disregarded it. Louis IX. of France (St. Louis) forbade the playing of chess at court under the penalty of a fine, and Edward IV. of England had a law enacted strictly prohibiting chess throughout the kingdom. James I. detested the game. The Knights Templar abhorred chess, and so did St. Bernard, and very many other church dignitaries, but this was probably for the same reason that Montaigne gave, that he hated chess because it fascinated him so.

A civil war in France owed its origin to a game of chess. Regnault, a nephew of Charlemange, and Berthelot, a knight of the court, had a quarrel while at the game. Berthelot struck his opponent in his anger, whereupon Regnault lifted the chess-board, which, as the story goes, was of solid gold, and struck him dead. A factional war of several years followed, which involved half the kingdom.—[N. Y. Mail and Express.

A WHALE ENTANGLED IN A TELEGRAPH CABLE.

In August of last year some articles under the above heading appeared in the daily papers, referring to a very interesting account of the breaking of a submarine telegraph cable by a whale. The account in question was somewhat meagre in detail, and not altogether correct; and my excuse for resuscitating the matter is that I have lately received a history of the circumstances from an eye-witness, and perhaps the story is of sufficient interest to merit a place in your columns. It struck me at the time that the subject was far too summarily abandoned, and that those who had full information at their command should have given more details. For instance, one would like to know the depth of water at the place where the whale was discovered attached to the cable, and whether any fault existed beyond the damage actually done to the cable, by the whale in its efforts to escape, or if there was any break, due perhaps to some submarine landslip. And I may here mention that the cables laid along the coasts of Peru and Chili (the one now under discussion forming part of this system) have more than once been broken by these submarine landslips, which, I believe, have generally been found to correspond with some severe earthquake felt on the coast.

It was stated in the account referred to that the interruption of telegraphic com-

munication was owing to damage caused by the whale. Now, if this were the case, one must believe that the animal, while groping about the bottom, had come across the cable, and had there gathered up sufficient slack so as to wrap several turns of the cable round it. It is difficult to understand how this feat could have been accomplished. Nor is this all; for, as more than a week had elapsed between the date of the interruption and the moment when the whale was discovered attached to the cable, we must also believe that during this time the animal had submitted to captivity, retaining for so long a period life and strength. In order to live, a whale must come up to blow; and if the one in question had done this, entangled as we are told, in the cable, it would have been obliged on each occasion to lift an enormous weight from the bottom, besides sustaining repeated injuries due to the strain of the turns of cable round it.

From my correspondent's letter, it appears that the cable was grappled for and hooked (how far from the point of interruption is not stated), and some considerable quantity picked up, when an abnormally heavy strain was noticed. The picking up was continued very slowly and cautiously, as it was supposed that the cable was to some extent buried. It soon, however, became evident, that the cause of the great strain was a huge mass, apparently attached to and coming up with the cable, and the astonishment of all on board may be guessed when it was seen that a whale some seventy-five to eighty feet long was entangled in several turns of the cable. On reaching the surface the animal commenced a series of plunges, which quickly resulted in the breaking of the cable close to the bows; and at the same moment the turns round the whale cut deeply into his body. After a few weak struggles and some spouting of blood and water, the whale lay motionless, the turns of the cable still remaining round it.

The ship, released from the cable, naturally drifted to leeward, and the stench emanating from the carcass is described as having been something awful. The cable appears to have been again grappled for, and picked up some little distance off, and the short piece attached to the whale at one end was buoyed at its other extremity. The repairing operations were continued, the whale meantime being sighted several times, and myriads of birds had collected around it.

The repairs being completed, the ship could not recover the short piece of cable attached to the whale, owing to the bad weather having suddenly set in, and it was necessary to lie-to during the afternoon and night. The next morning it was found that the whale had disappeared, and on recovering the piece of cable only a few pieces of blubber were discovered still remaining on the turns which had encircled the whale. The cable in the immediate neighborhood of the part which had imprisoned the animal was found to be much crushed, in many places the sheathing wires being forced open, the core destroyed, and the copper conductor broken, as if the whale in its endeavor to escape had tried to bite through the iron wires.

It seems a difficult matter to attempt a solution of how the whale became entangled. In the case of the Persian gulf cable to which a whale was found attached, I have heard it suggested that the animal, finding a portion of the cable suspended across some depression in the bottom, had tried to rub off, against the cable, lice which so much trouble these creatures, and in doing so had wrapped several turns around its body. I think, from the circumstances, that in the case now under notice such could not be the motive for the whale's interference with the cable. Perhaps some of your readers may be able to throw light on the subject.—[Cor. London Field.

A STORY OF TWO RATS.

A correspondent of "Land and Water" tells a story of two white rats which he had adopted as pets. The male was a quiet, commonplace sort of rat, acquaintance with whom afforded few incidents of particular interest. The female was a great coquette, and a regular domestic tyrant, exercising

absolute control of her spouse and household. Always pleased with the gift of some dainty, she was, "rapturously delighted" if allowed to think she had stolen it. If the master would have a piece of sugar on the table, she would creep up and take it, retreating behind a book to devour it, as she hoped, unobserved. She was a relentless enemy to mice; aud, when one of these animals was put into her cage, "she flew at it and slew it with a single bite, leaving it instantly, as a well-trained terrier does the rat it has killed." The first occasion of Anna Maria having little ones was quite an event. "When I went to the box, as usual, to give my little rodents a scrap of whatever I might have had, I found Augustus (the male) sitting out in the cold and looking terribly sheepish. On opening the sleeping compartment, there was Anna Maria, with something like a smile upon her shrewish little countenance, keeping watch and ward over nine ridiculously naked little offspring. On these occasions Augustus was completely effaced, He shirked the slightest responsibility; and I always had to make him up a separate bed, for sleep with his children he would not. If by chance he was forced to walk among them, he did so with an anxiety that would have done credit to an elephant stepping between eggs. As they grew up, assumed hair, and began to run about, he would allow them to take liberties with him, and even rob him of tidbits." The master thought the hay the naked little fellows were lying upon too rough for their tender skins, and put wadding in its place. "But, with a sneer of contempt for the stupidity of men in such matters, Anna Maria promptly cast out the wadding and bumped her progeny upon the hay again." In washing them, "she would roll them over and over with her paws, and lick them till the sparks flew; and they would utter plaintive little squeaks." But they throve splendidly. "Every night this graceful couple gamboled about my table while I read or wrote. It was a delight to me to watch them at their toilet or eating the food which they held in their delicate little paws When tired of play, they would clamber up to my shoulder and slumber, huddled together like two love-birds." Anna Maria at last died of a cold, and her place was supplied by a new female, whose chief peculiarity was that as soon as she had a family she would bite off her babies' heads."—[From Popular Miscellany, in Popular Science Monthly for September.

SONG OF THE ICHTHYOSAURUS.

[This curious specimen of German scientific humor refers to the close of the Jurassic (or Liassae) period and beginning of the Cretaceous, and describes the sad forebodings of a venerable Saurian, who sees in the degeneracy of the times a sign of the coming cataclysm.

The translator says, "Among the extraordinary liberties which we have been obliged to take with the letter of the original, in order to preserve as far as possible its spirit and its flowing movement, the most violent is the substitution in the last stanza but one, of an entirely new, (and poor) joke for the very neat but untranslatable jeu of the German. The last two lines of the stanza are:

'Sie kamen zu tief in die Kreide;
Da war es naturlich vorbei.'

The literal meaning is, 'They got too deep in the chalk, and it was, of course all up with them.' The allusion is to a score chalked up by a landlord against some bibulous but impecunious customers; and the notion that the saurians ran up so large an account for drinks that the chalk required to mark their indebtedness smothered the whole race, and brought on the Cretaceous or chalk period, is so absurdly funny that it is a pity to sacrifice it."]

There's a rustling in the rushes,
  There's a flashing in the sea,
There's a tearful Ichthyosaurus
  Swims hither mournfully!

He weeps o'er the modern corruption,
  Compared with the good old times,
And don't know what is the matter
  With the Upper Jura limes!

The hoary old Plesiosaurus
  Does naught but quaff and roar;
And the Pterodactylus lately
  Flew drunk to his own front door!

The Iguanodon of the period
Grows worse with every stratum;
He kisses the Ichthyosaurusses
Whenever he can get at 'em!

I feel a catastrophe coming;
This epoch will soon be done,
And what will become of the Jura
If such goings-on go on?

The groaning Ichthyosaurus
Turns suddenly chalky pale;
He sighs from his streaming nostrils,
He writhes with his dying tail!

In that self-same hour and minute
Died the whole saurian stem,—
The fossil oil in their liquor
Soon put an end to them!

And the poet found their story
Which here he doth indite,
In the form of a petrified album-leaf
Upon a coprolite!

—[Tidings from Nature.

THE PHILOSOPHY OF LONG LIFE.

In a very readable article on the philosophy of longevity, the London Standard says: "To make yourself miserable at 40 in the wretched ambition to add a few worthless years to your score after you have turned 70 or 80, is surely a poor-spirited sort of game. To spend one's life feeling one's pulse, looking at one's tongue, and asking one's self if one is treating one's constitution quite fairly, is not life at all. It is to live in a hospital, or at any rate, an infirmary. Still, there are some persons who are congenitally cautious, congenitally cold, congenitally calm. It is their nature to take things quietly, never to be in a hurry, never to excite themselves. They are content to sit in an easy chair for so many hours, read an agreeable book for so many hours, drive in a carriage when the weather is favorable for so many hours, and to regulate their existence by clockwork. They may live to 100, they may live to 1,000, but in truth they have not lived at all. The man who really gets the best that can be got out of life is the man who, with a fairly good constitution to begin with, is ready to squander it at any moment and on every occasion in a sufficient cause. He keeps no account of profit and loss with his vital energy; he sees work to do, and he does it; he sees pleasure to be enjoyed, and he enjoys it. He is alive all his life save when he sleeps; and he wakes from each fresh slumber looking cheerfully and encouragingly in the face, and ready and even eager to be a combatant when there is a good honest fight, and a runner when there is a good honorable race afoot. He may not live to be 100, but he may well live to be 70, 75, or even 80. He may have a career, if not so conspicuous, yet as active, as varied, and as restless as that, say, of Mr. Gladstone, and yet not be really old when time registers him among the aged. 'Better fifty years of Europe than a cycle of Cathay'; and better twenty years of uncalculated activity than the slow pulse and measured step of the circumspect snail that creeps slowly on to 100. We are not denouncing centenarians. They are like angels' visits, few and far between, and yet they are too rare not to be welcomed. Moreover, we doubt not that they deserve their length of years. But it would be a misfortune if it was ever thought an object of life to live very long. The object of life is to live, live generously, live bravely. As Shakespeare says, 'Ripeness is all.'"

OUTWITTING THE GHOST.

If primitive man knew how to bully, he also knew how to outwit the ghost. For example, a ghost can only find his way back to the house by the way by which he left it. This little weakness did not escape the vigilance of our ancestors, and they took their measures accordingly. The coffin was carried out of the house, not by the door, but by a hole made for the purpose in the wall, and this hole was carefully stopped up as soon as the body had passed through it; so that, when the ghost strolled quietly back from the grave, he found to his surprise that there was no thoroughfare. The credit of this ingenious device is shared equally by Greenlanders, Hottentots, Bechuanas, Samoieds, Ojibways, Algonquins, Laosians, Hindoos, Thibetans, Siamese, Chinese and Feejeeans. These special openings, or "doors of the dead," are still to be seen in a village near Amsterdam, and they were common in some towns of central Italy, as

Perugia and Assisi. A trace of the same custom survives in Thuringen, where it was thought that the ghost of a man who has been hanged will return to the house if the body be not taken out by a window instead of the door.

The Siamese, not content with carrying the dead man out by a special opening, endeavor to make assurance doubly sure by hurrying him three times round the house at full speed—a proceeding well calculated to bewilder the poor soul in the coffin.

The Araucanians adopt the plan of strewing ashes behind the coffin as it is being borne to the grave, in order that the ghost may not be able to find his way back.

The very general practice of closing the eyes of the dead appears to have originated with a similar object; it was a mode of blindfolding the dead, that he might not see the way by which he was carried to his last home.—[From "The Primitive Ghost and his Relations," by James G. Frazer, in Popular Science Monthly for September.

FRENCH WORKING PEOPLE.

The condition of the working people in France has steadily improved during the past seven years. Wages have increased from 10 to 40 cents, thus enabling laborers to live more comfortably. The effect of this is felt in more cheerful home life. Children enjoy a better education, and are not compelled to go to work until they reach the age of 12 or 13 years. The usual number of working hours is ten. The national habit of economy enables laborers to lay up a little money for old age.

The food of a French workingman consists of bread, wine, vegetables, and vegetable soup, with meat only at rare intervals. Breakfast is frequently a cup of black coffee and a piece of bread; dinner, soup made from salt pork and horseflesh or cheap beef and vegetables, and a portion of the meat with bread, and for supper, bread and meat left from dinner, with potatoes.

CURRENT LITERATURE.

NATURAL HISTORY.

THE STANDARD NATURAL HISTORY. Edited by John Sterling Kingsley Vol. I., Lower Invertebrates. Vol. II., Crustacea and Insects. Boston, S. E. Cassino and Company, 1885. Kansas City, C. E. Hudson & Co.

It is with sincere pleasure that the REVIEW calls attention to the two volumes described above. To those acquainted with the voluminous nature of the literature on the subject of Natural History, it might seem superogatory to add six additional volumes, imperial octavo, to it. But, while there is no lack of books and periodicals devoted to the investigation and classification of facts in zoological science, it is only just to say that there are few of these which treat of animated nature in a way that combines technical precision of statement and thoroughness, in all branches, with interest for the non-scientific reader. Indeed the most of the books on the subject, which pretend to a comprehensive character, are school text books and, like most books of this character, of very little interest to those who wish something more than a dry and cold catalogue of facts. The lack of such a book has been frequently commented on by writers, both in science and general literature, and the Natural History before us is the outcome of an attempt to meet the demand. That the attempt has been successful may be gathered from the praises bestowed upon it by eminent students. Professor Cope says: "In my opinion the Standard Natural History is the best popular work on zoology which has yet appeared. It has an exceptional advantage as the product of a corps of the best specialists that America affords, and is under the supervision of entirely competent editors." Professor Coues asserts "It will be by far the best thing extant," and Dr. Leidy, "I regard it in all respects the best and most reliable popular Natural History that has ever been published in our country."

The fact, alluded to by Professor Cope, that each department of zoological science will receive the attention of a specialist is worthy of note here. This branch of knowledge, like most others, has in our age assumed most formidable proportions. In the eighteenth century it was quite possible for the student to become versed in all that was known of the animal kingdom; but in our day the zoologist cannot hope for emi-

nence if he diffuses his labors over the vast mass of facts that connect in one science the humblest protozoa with the highest man. Thus zoology is divided into several fields and by choosing some one of these as a specialty, the student can achieve results of great and permanent value to science. Taking advantage of this fact, the publishers of the work in question have secured some of the best specialists in this country and, putting together their work, present us with a result wonderfully complete, harmonious and interesting.

The plan of the work is philosophical. Beginning with the lowest forms of animal life, the method of treatment follows the gradual development of complexity of structure and function and increase of intellectual powers until it ends with man. In accordance with this plan the work is arranged in the following order: Lower Invertebrates; Anthropods; Lower Vertebrates; Birds; Mammals; The Races of Man. Each group, into which these subjects are divided, is made the topic of an article by some prominent naturalist who has paid especial attention to its investigation; and by this means the latest discoveries and inductions, as well as the old established opinions, are ably and thoroughly presented.

The contents of the volumes received may be generalized as follows:

Vol. I. Lower Invertebrates. This volume begins with a general introduction to the Animal Kingdom, defining the terms used, and showing the field of Zoology as a whole. Following this is taken up, in systematic order, those simple, microscopic forms known as Protozoa, and then the Sponges, Jelly-fishes, Sea Anemones, Corals, Worms, Mollusks, Star Fishes, and Sea Urchins. The various articles are prepared by Prof. W. K. Brooks, of the Johns Hopkins University; Prof. S. F. Clarke, of Williams College; Dr. J. W. Fewkes, of the Museum of Comparative Zoology; Mr. A. F. Gray, of Danvers, Mass.; Prof. C. E. Hamlin, of Harvard College; Prof. Alpheus Hyatt, Boston Society of Natural History; Prof. Romyn Hitchcock, of the National Museum; Prof. D. S. Kellicott, of Buffalo, N. Y.; Dr. C. S. Minot, of Harvard Medical College; Prof. A. S. Packard, Jr., of Brown University.

Vol. II. Crustacea and Insects. The whole group of Animals with jointed limbs, of which half a million species exist, occupy this volume. Here will be treated the Lobsters and Crabs, Spiders, Thousand-legged Worms, Dragon-Flies, Grasshoppers, Bugs, Beetles, Moths and Butterflies, Flies, Ants, Wasps, and Bees. Among those contributing to this volume we may mention Prof. E. A. Birge, of the University of Wisconsin; Prof. J. H. Comstock, of Cornell University; Dr. Geo. Dimmock, of Cambridge; Mr. Henry Edwards, of New York; Prof. C. H. Fernald, of the Maine College; Mr. J. H. Emerton, of the United States Fish Commission; Dr. Geo. H. Horn, of Philadelphia; Prof. J. S. Kingsley, of Boston; Prof. A. S. Packard, Jr., of Brown University; Prof. C. V. Riley, United States Entomologist; Dr. P. R. Uhler, of the Peabody Institute at Baltimore; Dr. S. W. Williston, of the Yale College, etc.

If the first two volumes indicate, with any degree of accuracy, the standard of excellence to be expected in future volumes they will leave nothing to be desired in either manner or matter. It is a credit to the American press to produce such sumptuous volumes and a greater credit to the American people that their culture and love for knowledge, makes such a venture remunerative.

Apropos of this subject it is well to remind those whose interest it is to direct the studies of youth that there is no branch of knowledge so fascinating to the young as natural history. The writer's first remembrances are tinged with impressions received from a ponderous illustrated volume entitled "Animated Nature"—a volume over which many happy and profitable hours were passed; and there is no doubt that many adults can recall a similar experience, The boy who acquires early a taste for such literature is not apt to go astray in his later reading. While poetry, fiction, Belle Lettres, have their uses in this direction, their content is drier, to the boy or girl, and, it must be confessed, they are conducive to but a barren culture. Upon leaving school, the youth is so seldom encouraged to pursue further the threads of science, to be found in the curriculum of his studies that he forgets what little he learned. If parents would make judicious selections when presenting books to their children,the disposition to get knowledge would soon acquire a desirable strength as well as a judicious character. A work like the above would be the most useful and acceptable Christmas or birthday present a parent could give a child.

The Kansas City firm interested in this work, Messrs. C. E. Hudson & Co., is a late addition to the business enterprises of this city. The members are young, energetic and enterprising and come well recommended from the east. They have entered into a general subscription business, carrying exclusively the best class of such books.

AMERICAN ART.

Selected Etchings by American Artists. H. F. Richter Publishing Company, Philadelphia. C. E. Hudson & Co., Kansas City.

This is a collection of superb etchings by noted American artists and far surpasses anything of the kind hitherto shown in this city. Only one

hundred and fifty copies of this (the first) edition will be published, each of which will be numbered and signed by the artists. Buyers of expensive art works will be delighted with these etchings. Among the artists represented are the Morans (Peter and Thomas), Kruseman Van Elter, Henry Farrar, Samuel Coleman, etc.

It must be a pleasant reflection that Kansas City has a reputation for culture sufficient to bring such artistic productions into this market.

C. E. Hudson & Co. also handle some very fine medical works; especially on anatomical science.

MICROSCOPY.

THE MICROSCOPE IN BOTANY: A GUIDE FOR THE MICROSCOPICAL INVESTIGATION OF VEGETABLE SUBSTANCES. From the German of Dr. Julius Wilhelm Behrens. Translated and Edited by Rev. A. B. Harvey, A. M., assisted by R. H. Word, M. D., F. R. M. S. Illustrated with 13 plates and 153 cuts. Boston, S. E. Cassino & Company, 1885, pp 466. Price, $5.00.

The scope of this work is confined within very sensible limits. Generally it is thought necessary by writers on the microscope to prelude the practical portion of their works by treatises on optics, or on the special sciences to which it is applicable. But Dr. Behrens, a practical Microscopist himself, takes it for granted that his reader is acquainted with those branches of science which must be known before the microscope can be intelligently used; hence he expects the student to acquaint himself with the optical and histological branches of the subject before taking up his book. Such a reader will find this guide to the microscope, in the investigation of histological botany, not only useful but almost indispensible, especially so if he is an amateur or a beginner in the science.

The early chapters describe the microscopical apparatus and appliances necessary for satisfactory work with directions how to use them. Along with this part of the treatise is given full and intelligible directions for the preparation of specimens. Following are chapters on microchemistry, microscopical reagents and the microscopical investigation of vegetable substances. While all of these chapters contain, practically, a digest of our knowledge on the subjects treated, yet the last named is especially admirable and exhaustive; though, at the same time, its arrangement is so lucid and intelligent that it makes the student largely independent of the costly and, sometimes, unobtainable literature on this head. The book is not a mere compilation but embodies largely the results of original work. The American editors have performed their work well, though a disposition is manifested to over-crowd the text with praise of certain makers of apparatus and too frequent references to their address.

As to the style of presentation, too much cannot be said in its praise. It is a fair example of the lavish American method of printing books of this character.

HEGEL'S ÆSTHETICS. A CRITICAL EXPOSITION. By John Steinfort Kedney, S. T. D., etc. Chicago, S. C. Griggs & Company 1885, pp. 302. Price, $1.25.

This volume belongs to the series of German philosophical classics just alluded to. The treatise of which is an epitome, or abstract, constitutes one branch of the most difficult of all philosophies. It is true that Hegel approached occasionally the simplicity of Greek dialectics; but it is only just to say that the spirit of his philosophy is almost beyond the reach of western thought; it is so far removed from the inductive method which now dominates every field of inquiry. It is equally true that the study of any other German philosophy, except that of Schelling, gives little aid to the student in comprehending or appreciating Hegel. For these reasons the work of Dr. Kedney will prove useful to those who share the renewed interest which Americans seem to nourish toward metaphysical and physiological studies. Hegel's conceptions of an absolute spirit in art, religion and philosophy; of the adventitiousness of natural beauty in distinction to the legitimacy of artistic beauty; of the intimate relations between art and religion and philosophy; are so closely allied to certain forms of contemporary thought that we may look for a revival of Hegelianism on novel grounds at no distant period.

Prof. Kedney preserves the content of Hegel's system with singular fidelity (for so compressed a digest) and his own comments and elucidations are always judicious and intelligible.

FICHTE'S SCIENCE OF KNOWLEDGE. A CRITICAL EXPOSITION. By Charles Carroll Everett, D. D., author of "The Science of Thought," etc. Chicago: S. C. Griggs & Company, 1884, pp. 287. Price, $1.25.

This book is one of a series of "German Philosophical Classics for English Readers and Students," now in process of publication by S. C. Griggs & Co.

Of all the philosophical systems which originated in, or took direction from, the study of Kant, none are worthy of a higher place in the history of modern thought than that of Fichte. It has exercised an important influence on the development of the naturalistic movement, incited by the Cartesian method and carried to such

wondrous heights in the science of our day. But this, like all German philosophies, has been sealed to most readers by the difficulty of its terminology and its rather verbose statement. Dr. Everett has performed a great service to American readers by his lucid, yet brief, presentation of Wissenschaftslehre of Fichte. Like the former volumes of this series, the present one shows the works of competent scholarship and criticism in its preparation.

A STRANGE MANIA.

THE DANCING MANIA. By J. F.C. Hecker, M. D. No. 72 of the "Humboldt Library of Science." J. Fitzgerald, Publisher, 393 Pearl St., New York. Price, 15 cents, post free.

The Dancing Mania of the Middle Ages is one of the most curious episodes in the history of mankind, whole villages, towns, and communities being seized with an irresistible impulse to dance and leap about, and to wander up and down the whole of Europe, communicating their frenzy to the people wherever they wandered. The symptoms of this strange disorder, and the mad antics of its victims are vividly portrayed by the author from contemporary annals.

Other Publications.

LOCAL INSTITUTIONS OF MARYLAND. By Lewis Wilhelm, Ph.D., etc., Baltimore. N. Murray, Pub. Agt., Johns Hopkins University, 1885.

BULLETIN DE LA SOCIETE ROYALE DE GEOGRAPHIE D'ANVERS. 8th Annee sociale, 1884–5. Anvers. Imprimerie Veuve de Bocker, Rue Zirk, 35, 1885.

THE DANCING MANIA OF THE MIDDLE AGES. By J. F. C. Hecker, M. D. Fr. by B. G. Babington, M. D. F. R. O., J. Fitzgerald, New York, 1885.

AN ACCOUNT OF THE PROGRESS IN ANTHROPOLOGY IN THE YEAR 1884. By Prof. Otis T. Mason. Washington: Government Printing Office. 1885.

CORRECTIONS OF THERMOMETERS. By Thomas Russell, Junior Professor, office of Chief Signal Officer: Washington City. Signal Office. 1885.

BULLETIN OF THE PHILOSOPHICAL SOCIETY OF WASHINGTON. Vol. VII. Washington, 1885.

FOURTH BIENNIAL REPORT OF THE BOARD OF DIRECTORS OF THE KANSAS STATE HISTORICAL SOCIETY. Presented to the society at its ninth annual meeting, held at Topeka, January 20, 1885. Topeka, T. D. Thacher, State Printer, 1885.

REPORT OF THE PROFESSOR OF AGRICULTURE, KANSAS STATE AGRICULTURAL COLLEGE. EXPERIMENTS. 1884. Manhattan, Kansas: Printing Dept. State Agric. Coll., 1885.

CIRCULARS OF INFORMATION OF THE BUREAU OF EDUCATION. No. 2, 1885. Teachers' Institutes. Washington: Gov't. Printing Office, 1885.

PERIODICALS.

One never tires of praising the Magazine of American History, for it represents so much sterling merit and so little that appeals to the love of sensation, so prevalent in the world and so catered to by magazine makers. The September number is especially attractive. Aside from the illustrations, which comprise a steel portrait of General Grant, in military uniform and illustrations of old houses at Riverside Park, there is sufficient in the articles to interest the most blase magazine reader. Mrs. Lamb, the editor, furnishes an article on the "Historical Associations of General Grant's Resting Place," for which her past studies and achievements have fitted her. This is followed by "Washington's first Public Service" by J. T. Chapman, A. M., "Baltimore in 1861" by Maj. Gen. Jno. C. Robinson, "The Beginning of the Civil War in America." The Rebels taking the offensive," by Gen. Thos. Jordan, "Military Affairs in New York State in 1861;" by Gen. Meredith Reed. The other articles are 'Closing Days of LouisXIV" and "Tributes to Gen. 'Grant." Published at 30, Lafayette Place, New York.

The North American Review for September opens with a symposium on "Grant's Memorial: What shall it be?" wherein the subject is discussed from various standpoints, and by eminent representatives of culture and art. The same number of the review contains a consideration of the question "Shall our National Banking System be Abolished ?" by George F. Boutwell, F. J. Scott, S. Danna Horton, and Edward H. G. Clark. "Ouida" contributes an essay on "The Tendencies of English Fiction," and Elizabeth Stuart Phelps writes on "The Great Psychical Opportunity." Mr. French, late Sergeant at Arms, writes "Reminsciences of Famous Americans."

The Journal of the Franklin Institute for September, has for its initial paper, an article by John Sartain "On the Ancient Art of Painting in Encaustic," elegantly illustrated. The frontis-

piece, an illustration of this article, is a reproduction on steel of an exquisite specimen of ancient art in encaustic painting. It was discovered in the ruins of Hadrian's villa, and is supposed to represent Cleopatra receiving her death from the bite of an Asp. Another illustration is a reproduction of the "Muse of Cortona," an encaustic discovered by a farmer while plowing in a field near Cortona. Other articles are "On the New System of Telegraphy to and from Moving trains, by the use of Electric Induction," by P. H. Vander Weyde, M. D. "A lecture on Matter, including Radient Matter," by Alex. E. Otterbridge, Jr., etc.

The ever seasonable Popular Science Monthly is at hand for September and presents its usual attractive bill of fare. "The Relations of Railway Managers and Employees," by Dr. W. T. Bernard, is the first paper, which is very pertinent in the light of recent events in the west. Among other papers are "The present Aspect of Medical Education," by Wm. G. Thompson, M. D.; "Insect Fertilization of Flowers" by the eminent German botanist, Dr. Behrens; "Origin of Man and the other Vertebrates" by Prof. Cope; "The Fauna of the Sea-shore," by Prof. Mosely; "How Spelling Damages the Mind," by F. A. Fernald; "Recent Progress in Biology" by Prof. Lankister; "The Primitive Ghost and his Relations," by James G. Frazer, etc. The "Popular Miscellany", is full of interesting matter.

The August number of Mind in Nature completes the first half year of this unique and entertaining magazine, and fully sustains its reputation. This number has the inaugural address of Dr. A. Reeves Jackson, President for the Western Society of Psychical research. A resume of Mrs. Sidwick's report on Haunted Houses. A paper by Mrs. U. N. Gestefield on Common Sense versus Medicine; some interesting and curious mesmeric experiences by H. M. Hugunin; the continuation of Bishop Coxe's articles—this time on Mischances. Brief papers by Rrof. J. D. Butler, A. N. Waterman, and Lilian Whiting. A poem on Secret Thoughts by Ella Wheeler-Wilcox, with the usual amount of editorial matter, reviews and selections.

The old and popular Van Nostrand's Engineering Magazine gives its subscribers an exceedingly readable number for September. "The Relative Value of Tidal and Upland Waters in Maintaining Rivers, Estuaries and Harbors," by W. R. Browne, M. A., M. Inst. C. E.; "A Sketch of Roman Building Construction," W. T. Oldreve; "Three Problems in River Physics," by Prof. J. B. Johnson (Wash. Univ., St Louis), are some of the papers.

The frontispiece of The Woman's Magazine for August is "Aurora" drinking from morning-glory cups. The idea is carried out in some verses on "The Flower that Named Itself." Part II, of Miss Francis E. Willard's "Story of the Pyramids," tells of climbing Cheop's Pyramid, the outlook from the top, and the "Singing of the Rock of Ages" in the empty tomb at its base. "The Closest Tie," a true story of life in lumbering regions presents a strong contrast of woman's work. Mrs. Emma P. Ewing discourses on "Coffee–Tea–Toast," This number closes the eighth volume.

Among the papers, in the American Naturalist for August, the following may be noted for special interest or excellence: "Notice of some Human Remains found near the City of Mexico" (Illustrated) by Mariono de la Barceno; two continued articles, "Evolution in the Negotiable Kingdom" (Illustrated) by Lester F. Ward and "The Relations of Mind and Matter," by Charles Morris; and "The Use of Copper by the Deleware Indians," by C. C. Abbott. Under "General Notes" an admirable record of the progress of science is presented each month, and it does not lose character in this number.

The August number of the American Meterological Journal, manifests the robust character of the knowledge this periodical is circulating. Meterologists are gaining ground in establishing their study as a true science, by means of which true prevision is possible. "A remarkable Hail Storm" by J. H. Stathem, and a "Seven Day Weather Period, with Cuts and Tables," by H. H. Clayton, are interesting and useful papers. The prediction of Mr. Clayton in this number as to August weather, has been fulfilled in this latitude with great fidelity.

Mr. Proctor's Magazine, Knowledge, for July is at hand, and it would be a surfeited reader, indeed, who could regard its table of contents without pleasure. It contains a very Salmagunda of matter, "from grave to gay, from lively to severe." Without being invidious, attention is called to the paper of William Curran (reprinted in the REVIEW this month) on "Life in Death;" "Illusions of the Sense" by R. A. Proctor; "Photography and Medical Jurisprudence," by W. Mathews, etc.

The Journal of Science, (English),for August is an extremely interesting number. Oswald Dawson contributes a very trenchant, but ill-natured criticism of Mr. Darwin's Origin of Species. The author of Scientific Materialism contributes a paper on "Relations Between Spiritualism and Scicence." Other noteworthy papers are: "On the Chemical Action of Light," and "On the Problematical organisms of Ancient seas."

Uuder the management of the Danas the American Journal of Science has suffered no deterioration from the standard set by the Sillimans. The August number contains several articles of

more than ordinary interest. Prof. J. D. Dana treats of the "Origin of Coral Reefs and Islands;" C. M. Shepard discusses the "Meteorite of Fomatlan, Jalisco, Mexico;" T. C. Mendenhall describes a "Defferential Resistance Thermometer," etc.

American Microscopical science has an able ally in the American Monthly Microscopical Journal, which is frst becoming indispensible to Microscopists. The August number is well filled with useful papers in this science, among which may be mentioned "A Practical Method of finding the Optical centre of an Objective and its Focal Length" (Illustrated), "Cleaning Marine Mud," "Measurement of Blood Corpuscles," etc.

The American Antiquarian and Oriental Journal (Quarterly) for July presents several very interesting features. Among the papers are "Ruins at Copan and Palenque," by L. P. Gratacap (Illustrated) notes by the editor; "Ancient Works on Iowa," by Prof. Thomas and "Native American Symbolism" by the editor. The usual departments are well filled with attractive matter.

The August number of Literary Life being the first number of volume IV, contains the first part of Joaquin Miller's great poem, "The Sword of the South." This poem, written in and for the South, he prophesies, will shake the rafters of heaven. It is for a juster appreciation of the true situation of the Southerner.

The Kansas City Medical Index for August contains some papers of a timely interest to the medical profession, such as "Cancer" and "The Theropeutics of Cocaine."

Science (weekly) is always welcome and we try to show a proper appreciation of its excellence by dipping our beak into its columns occasionally, as we do this month.

The American Inventor for August comes full of interest and news from the Patent Office. It is astonishing how multitudious American inventors are growing.

The Canadian Science Monthly gives us some original work in "Notes on the Birds of Manitoba," and "The Home of the Pitcher Plant," in the July number.

The Household for August comes full of good things for the housewife and the family.

Other publications received are The Fountain, for August, the Telegraphic Journal and Electric Review (weekly) English; the New York Electrical Review (weekly): the Engineering and Mining Journal (weekly); the Age of Steel (weekly); the California Architect for August; the Gardener's Monthly and Horticulturist for August; the Journal of Mycology for August; The Chemical News (weekly); Scandinavia for August; The Electrician and Electrical Enquirer for August; the Iron Trade Review (weekly); The Sugar Beet for August; Le Leehuologiste (weekly;) LeMoniteur du Commerce, (weekly;) Monthly Weather Review for June; The Spokesman of the Carriage and Harness Industries for August; Plain Talk for August; The Mining Review, weekly; The Progressive Age and Water-Gas Journal, for July; the Manufacturers and Builder for August; the Missouri School Journal, (weekly;) the New England School Journal, the Boston Journal of Commerce, (weekly,) etc.

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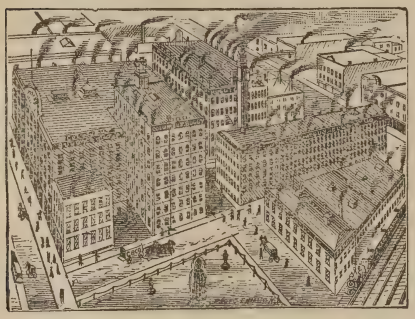
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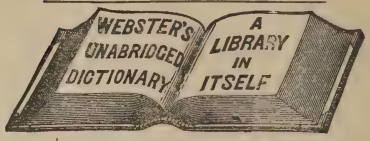
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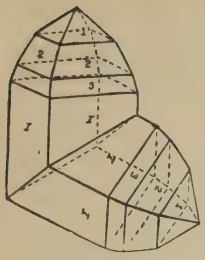
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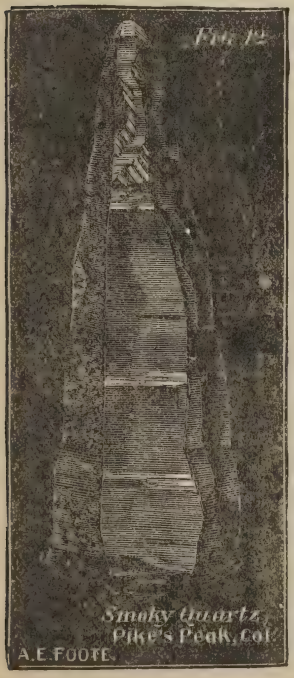
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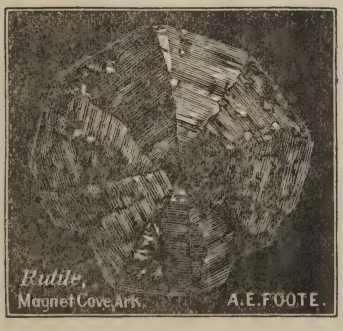


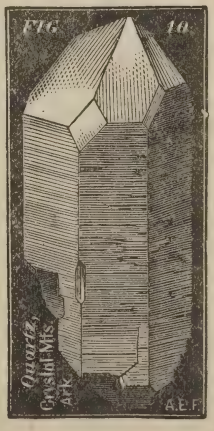
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CONTENTS:

PAGE.

Stonehenge and Avebury. PROF. J. MCLAIN 139
History of Aryan Languages. PROF. L. WIENEB 144
Herbert Spencer's Essay on Religion. I. N. C. KOUNS 150
Life in Unconsciousness. FREDERICK HARTMAN 156
Hypnotism. J. B. BROWNING, M. D. 160
American Association for the Advancement of Science. E. L. LARKIN 164
"The Cradle of the Human Race at the North Pole." EDWIN COOMBS 169
The Song Notes of the Periodical Cicada. C. V. RILEY 173
A First Prize Essay on Disinfectants. DAVID ECCLES 175
EDITORIAL: Vivisection—Sense-Illusions—Parks—Electric Railway, Etc 181
CORRESPONDENCE: Change in the Nebula in Andromeda—Two New Chemical Terms 184
SCIENTIFIC AND INDUSTRIAL NOTES—Formation of Coal—Ancient Methods of Washing Gold—The Creeping of Rails on the St. Louis Bridge—Where Tornadoes Most Abound—The Longest Bridges in the World—Edible Earth—A Black Inventor—A Marvelous Gold Find in Michigan—A Coal Battery—The New Star in Andromeda—Labor and Capital—Telegraphing to and from Moving Trains—The Age of Mounds—Vivisection of Dogs—Meteorology of September—Astronomical News—Can Underground Heat be Utilized—Influence of Forests, etc., etc 185
MISCELLANY—Pigmy Animals—Sunday Observance—A Boos-Ke-Tan—About Perfumes—Reynard's Ways—The Country of Stilts—Diamonds—A Queer Way to Get Fresh Water—The Fighting Instinct in Man—Crinoline in Classic Days—A Singular Haven in the Sea—The Invention of Ink—Canine Attachment for a Horse—College Men in Literature—A New Use for Toads 198
CURRENT LITERATURE—Phonetics—Political History—Santitation—Evolution—Astronomy—Other Publications—Some Things From the Magazines 208

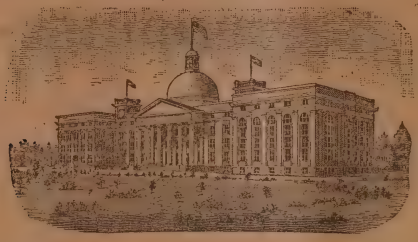
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The KANSAS CITY REVIEW'S modest cover does not in any way detain the gazer, but a glance beyond lures one to read on, and, reading, he becomes convinced that Kansas City literature, though it is from the West, has made a career for itself. We learn through the Periodical of a paper on "Photography and Medical Jurisprudence," by W. Matthews.—*Photographic Times and American Photographer.*

I herewith enclose $1.00, which I believe pays for the REVIEW up to January, 1886, as per your advertisement. Congratulating you upon the auspicious commencement you have made in your new enterprise, I remain,

Yours Truly, CHAS. E. PUTNAM,
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VOL. IX. OCTOBER, 1885. NO. 3.

STONEHENGE AND AVEBURY.

Wiltshire, an inland county of England, contains the two greatest circular ruins of pre-historic times that may be found either in the British Isles or in Europe. Stonehenge, which has received the greater notoriety, is situated in the center of the plain of Salisbury. It is located two miles west of Amesbury, and seven north of Salisbury. The plain is an undulating chalky table-land, drained by the river Avon, and having an elevation of five hundred feet above the sea level.

In the vicinity of Stonehenge are about four hundred tumuli, ten other ancient structures, the camp of Vespasian, camp of Clorus, the remains of two Roman roads, and the site of the Roman city Sarum.

In the early part of the present century Stonehenge was comparatively entire, but at the present time, appears to be little more than a confused mass of moss covered stones. A close inspection, however, enables one to trace out its original form. Originally it consisted of two concentric circles of upright stones which enclosed two ellipses, the whole surrounded by a circular embankment and ditch, the wall being fifteen feet high, and one thousand and ten feet in circumference. Exterior to the outside boundary was a single upright stone. To the north-east was an approach or avenue, bounded on either side by a wall and ditch.

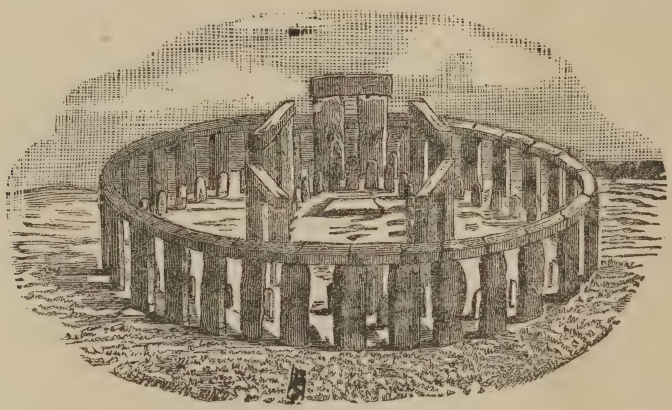
The structure itself was composed of one hundred and forty blocks of erratic sandstone and boulders, weighing from ten to seventy tons each. Other stones of the same kind may be seen lying around the country, all of which appear to have come from the north of Scotland during

the Glacial Age. The outer circle consisted of thirty stones fixed upright, three and one half feet apart



PLAN OF STONEHENGE.

and connected at the top by a continuous series of imposts, sixteen feet above ground. The stones composing this top layer were squared, rough-hewn and dovetailed together, and with mortise holes in their under sides for the reception of the ten-



STONEHENGE RESTORED.*

on of the upright blocks. Seventeen of the stones of the outer circle still remain. The inner circle was removed a distance of nine feet from the

*For this illustration and that of Avebury, we are indebted to Mr. E. A. Allen. They are taken from his "Pre-Historic World."

center, and also consisted of thirty unhewn granite pillars, bluish in color, varying from five to six feet in height. Eight still remain entire, with fragments of twelve more.

As may be seen from the illustration, which represents the work as restored, the most imposing part of the fabric consisted of the center ellipse within the circle, formed of ten blocks, in pairs, from sixteen to twenty-two feet in height, each pair furnished with an impost, and so arranged as to form five trilithons. Of these, eight still remain. Within this ellipse is the inner oval composed of twenty upright stones, similar in size to those of the inner circle, eleven of which are still standing. * In the cell thus formed and near the curve of the inner ellipse was the large slab of blue marble, called the sacrificial stone. Our illustration showing the ground plan will afford a good conception of the two circles and the two ellipses.

What was the object of this wonderful structure? when and by whom made? are questions which have been fully discussed, and must be of great interest to every student of his race. Any ancient structure, whose history has been lost, will have idle tales surrounding it, and plenty of theorists to put forth their ideas concerning its origin and use. Yet enough data generally remain by which its object may become known, and by whom erected. Clustering around the old ruins of Stonehenge is the legend entitled the "Dance of the Giants." It is first found in the "British Chronicle" of the tenth century, and repeated by Geoffrey, of Monmouth, and afterwards by Giraldus Cambrensis at the close of the twelfth century. The last named says: "There was in Ireland, in ancient times, a pile of stones worthy of admiration, called the Giant's Dance, because giants from the remotest parts of Africa brought them into Ireland, and in the plains of Kildare, not far from the castle of Naas, as well by force of art, as strength, miraculously set them up. These stones Aurelius Ambrosius, King of the Britons, procured Merlin by supernatural means to bring from Ireland into Britain." The story relates that Aurelius desired the structure in memory of the British cheiftains who were treacherously slain by Hengist and the Saxons, about the year 460. Aurelius was a Roman and was king of the Britons A. D. 481, which, according to account would fix the date towards the close of the fifth century.

It has been argued that Stonehenge is post Roman, not only because both Roman historians and geographers have failed to mention it, but also on account of the name itself. When these arguments are sifted it is shown that there is nothing in them. Because the Romans failed to mention the structure, that is no reason it did not then exist.

*A recent writer in Harper's Magazine December, 1884, says "Only the central circle and a few other stones remain.

One of the most important fortifications erected by the Romans, while masters of England, was the Caledonian Wall, yet only one Roman historian makes any allusion to it. No Roman contemporary of Christ makes mention of him, yet that by no means proves that no such man as Jesus of Nazareth ever lived.

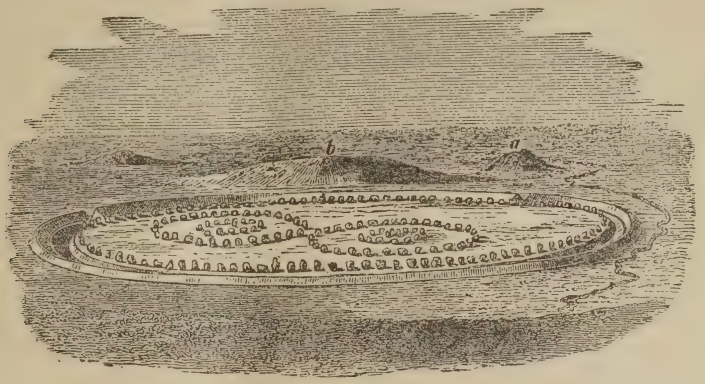
So far as the name itself is concerned, had we no other evidence, that would be a very strong argument in favor of a post Roman origin. As arguments, we cannot close our eyes to the fact, names must go a long ways. It is worth while to examine the names, for here we will undoubtedly obtain the sequel. Once the place was called *Stoneng*, and in the vicinity is still called *Stonage*. Its present name is Stonehenge, which is said to be Saxon, meaning, "hanging stones," or "Stones of Hengist," named for the mythical commander of the original Saxon invaders. Why should the Britons name this memorial structure after one who had murdered their chieftains? Perhaps a better etymology may be obtained. If the name by which the Kelts called this structure had not been departed from, no difficulty would have arisen in considering its origin and use. The great desire to throw aside purely Keltic names and adopt those of supposed Saxon origin has been a fruitful source of error. The original Kelts called Stonehenge *Coir-mhor*. *Coir* means justice, right, equity (from this word we receive our English *court*, as applied to justice. From it the French obtain their *cour*, same application). *Mhor* (*mor*) means *great*. Hence the words in combination signify "The Great Court," or Great Court of Justice." At once this would make the ruins a druidical structure. This ancient priest-hood were judges as well as members of the sacerdotal office. England was the principal seat of this order, and who knows, but at Stonehenge and Avebury the Arch-Druid presided in person.

After the Saxon and Danish invasions the Keltic (Gaelic dialect) *Coir-mhor* was interpreted by the monastic writers into the Kymric (another dialect of the Keltic tongue) *choir-gaure* or *vaure*; and in turn from the Kymric into the Latin *chorea gigan-teum*, or the "dance of giants." A name so peculiar must have an origin. The monks, always equal to the occasion, invented the story of the giants who danced from Ireland, carrying on their backs the great stones with which to build the temple.

The name *coir-mhor* was applied to the stone circles of Ireland and Scotland; which would clearly indicate that they were used for judicial purposes. As they were erected by the priest-hood, they may also have taken a sacred character.

A structure erected after such a stupendous amount of labor must have been considered as a place of the utmost importance, and consequently needing protection from the intrusion of both enemies and the

profane. Hence we find it guarded by a wide series of dykes or intrench-



AVEBURY.

ments. These ditches, or dykes, or intrenchments, the Britons called *staingeach*, *i. e.* abounding in dykes or intrenchments. *Staing* means an intrenchment; *staingich*, to intrench. Probably it is here where the Saxons derived the wild legend of "hanging stones," or "Stones of Hengist."

Sir John Lubbock assumes this structure to belong to the Bronze Age. Others following the same thought assume the outer circle to have belonged to the Iron Age, because the joints in the stone would require the use of iron. It is more than probable that work was continued on the structure until it was completed, and when completed only represented the original design. If it should be clearly proved that Stonehenge belongs to the Bronze period, that would not do away with its Druidical character, for the Druids may have passed from the Bronze into the Iron Age, and for aught we know, may have commenced in the Stone Age.

This ruin is located twenty-five miles north of Salisbury and six miles west by north of Marlborough. It is the largest ruin of its kind in Europe or the adjacent islands. It was first brought to notice by Dr. Stukeley, in the year 1740, although a manuscript account of it is still in existance, which was written by command of Charles II. in 1663. The work is located on a level area of four hundred and seven yards in diameter, bounded by a deep ditch and a high embankment. The circle consisted of a hundred large blocks of stone placed on end. Within this enclosure were two other circles, one of which, a double concentric circle, consisted of forty-three upright stones, with a single stone in the center; the other similar to it was composed of forty-five stones with three large and high blocks in the center. The embankment surrounding the temple had two gate-ways,

one to the East and the other to the West, approached by avenues of a mile in length and varying from thirty-five to fifty-six feet in width. These avenues were accompanied with a range of blocks on either side. Near this structure is Silbury Hill one hundred and seventy feet in perpendicular height. This is the largest artificial mound in Great Britain.

Lubbock (*Pre-Historic Times*, page 53), gives a plan of this work.

HISTORY OF THE ARYAN LANGUAGES.

I.

Nations have carefully preserved legends and myths of their early existence and wanderings, from which an approximate idea of the continuous development from their infancy towards manhood can be evolved; but there is at the present state of philological research and knowledge, very little material available for the history of the childhood of Aryan speech. We accept, we feel, we are convinced that at an early time of the earth's age there was spoken by a large part of mankind a language which, for the want of a better name, we designate by the name of a race that more than any other is the inheritor of this ancient speech; and, probably, this language was once strictly confined to the Aryans, for, as Max Muller says: "Nations and languages were in ancient times almost synonymous; and what constitutes the ideal unity of a nation lies far more in the intellectual factors, in religion and language than in common descent and common blood."

We know not, cannot even conjecture, at what time the independent development of the separate families began.

About the thirty-first century before Christ one part of the race settled the country between the Indus and the Jumna and called it Arya Varta "the Land of the Just" (hence the name Aryan). The migratory Celt had gone to Minor Asia and the North of Africa; from thence over Gibralter to Gaul, and by another way, with great probability, over the Bosphorus to Italy. Another family came later by the Caspian Sea route and mixed with, or superseded, the Pelasgi, a Turanian race, in Greece and the Celts in Italy. Whether, under the influence of the Pelasgian and Celtic, the Aryan tongue yielded its original forms and developed itself into two distinct classes—the Greek and the Latin—or whether these latter were only slightly modified by the indigenous vocabulary—is hard to decide at present.

Meanwhile the Celts settled the British Islands where they kept their language for many centuries in unadulterated purity. The Slavs roamed over the vast Sarmatian plain and cultivated the soil wherever the con-

ditions were favorable, while the Goths, or rather Teutons, occupied the middle and the northern part of Russia. The cognate tongue to the Slavonic, the Lithuanian, can be traced back no further than historical times when it established itself in western Russia.

The Rig Veda is the oldest document of Sanskrit; the Prakrit appears as early as the sixth century before Christ; since that time the literary language gives way to current idioms which at the present time have increased to several scores and retain their literary independence. The noblest of them all is the Urdu and its sister-dialect, the Hindi, which, if they have lost the pliability and metaphysical correctness of their worthy grandam, still charm the ear with their gorgeous dictions.

The holy books of the Parsis are documents of a language that highly resembles old Sanskrit; and proves, by the retention of the terms refering to the Soma worship, that its development began contemporaneously with the settlement of the country beyond the Indus by the Sanskrit speaking people. The sibilants of the Sanskrit are aspirates in Zend; the declensions in conjugations in both are nearly alike; of the few dialects that existed after the decay of Zend, Persian is foremost; Persian has shortened the endings, simplified the verb and amalgamated with the Arabian vocabulary; it is the language in which the Koil flutes—soft, rolling, from cadence to cadence, lulled by ingenious word reverberations.

From the testimony of early historians, and from the few inscriptions existing in Asia and Europe it is generally accepted that Gallatia in Minor Asia, Gallia of Cæsar, Gaedhel of the Irish, and Haldgastes of the Teutons are identical with Celt; it is also believed that the speech of the Gallatians, Gauls, and early inhabitants of Britain was identical, and that only after the settlement of the Gauls in the British Islands it separated into Irish and British. Of the Irish at the present three dialects are extant: the proper Irish, the Scotch Gaelic, and Manx; of the British also three: Kymragor Welsh, Armoric, and Cornish. Armoric stands in the same relation to Cornish as Gaelic to Irish, and Portuguese to Spanish. The Irish is nearer the original Celtic than the British, as it retains copious internal changes in declensions and conjugations which British has nearly all lost. The tip of the tongue pressed towards the teeth, being pre-eminent in the enunciation of the consonants, aspiration and ellipsis is often the result, which consists in softening the hard consonants and suppressing the harder before a softer one. If a language is to be judged by its best and most persistent productions I should call the Irish—the lyric language—very well adapted to wed Music to the immortal Muse. Following the mythical genealogy of the Greek people the Æolic dialect is the old-

est, then came Doric, then Ionic; this fully agrees with what we can infer from the fragments of Æolian, Dorian and Ionian literatures. Æolic, with its prevalence of the *o* and *u* sound, though so well moulded into a language of passionate love by Sappho and the other Lesbians, has rarely been used for literary purposes. It was regarded as a barbarian dialect by the Athenians. The earnest Doric with its broad *a* was well calculated for choruses in tragedies and war-clamors. The luxurious Ionic abounded in soft *e* and admitted of various uses to the sensitive ear of the Greek author. The mean of Ionic and Doric, the Attic, began to set aside all other dialects in the middle of the fifth century B. C. and presents a most artistic and perfect structure of grammatical forms. Only little was it changed in Alexander's times who carried it to his conquered nations, nor was it changed later on by Alexandrian writers; even the Hellenistic Greek of the Septuagint and the Byzantine Greek of the middle ages have merely added some barbarian words, and neglected established grammatical rules, rather than brought in new forms. The modern Greek, of which examples are to be found as early as the sixteenth century, in its literary and conversational form as used by the educated classes, is ancient Attic made easy; the language of the vulgar deviates from it only in a motley collection and incorporation of Roumanian, Slavonic and Turkish words into its vocabulary.

Not so happily has fared the Latin, the conqueror of the world and the master over educated minds in Europe as late as the eighteenth century. Among the Umbrian, Oscan and other dialects, Latin can be studied in its archaic form on sundry inscriptions and in ancient imprecations; it became soon the language of the subtle lawyer and the daring warrior and was in the flower of grammatical and rhetorical development in the Augustan age; a fine satire pervaded it; the people spoke it; the soldiers and conquered nations used it in Spain, in England, in France, in the Alps, on the Danube. Rome fell, and the Latin language with it; after this it led a precarious existence in the Catholic church and in sequestered cloisters up to the latter part of the middle ages and at this period very justly deserves the name of Kitchen Latin.

In the thirteenth century the Italian people began to cherish a patriotism for the vulgar tongue which was far softer than the original Latin. About that time the Spanish dialect, influenced by Gothic and Arabian, brought forth its full-sounding, silver-clanging, chivalrous Castilian in ballads and romances; then borrowing some from the French and some from the English it sent off a shoot as Portuguese. The French itself—a hashed, barbarous Latin in the ninth century—began to acquire rounded shape, and to vie in elegance with its older sister, the love-singing

Provencal. Only very lately did the Roumanian spring into a written existence, a remnant of rustic Latin, seasoned with a Slavonic vocabulary. A few other waifs are to be found within the Alps.

Hardly any family is so well provided with a numerous and strongly resembling posterity as is the Slavonic. In earliest times we hear already of Polish, Bohemian and Bulgarian. From their inter-marriage arose those numberless Slavonian, Slavac, Croatian, Ruthenian, Carpathian and other dialects. The Bulgarian was a harsh, complicated language, and in the ninth century of the national existence of the Slavs it became the church language of the Greek Catholic Slavs. This was superseded later by the New Bulgarian, an easier and more fluent speech. The influence of Bulgarian on the native dialects was very great; with the Muscovitish it gave the elegant literary Russian language as early as the sixteenth century; side by side with it went the development of the Little Russian and Servian, Bulgarian and others. The Polish gave no literary off-shoots; it is more plastic than the Russian, more sensitive to consonant changes, and has more nearly retained the nasal sounds of the Old Slavonic. The Bohemian in its form is nearer the Russian than the Polish, has broad vowels and is spoken from the chest. As all of the Slavonic languages stand closer together than French and Spanish and the other Romance languages, it has been a dream of the Panslavist to create one common literary language for all: a dream, and a fair dream it is! Were it not for the Lettish, a child of the Lithuanian, which possesses lyric poetry and a remnant of an epic poem, and is spoken by, probably, half a million of men, the Lithuanian would hardly be noticed; still on account of its peculiar structure, in which it resembles the Sanskrit, it is a valuable factor in philological research and will help some day to elucidate the history of the Aryan tongue.

In the fifth century the Goths appeared in Europe; but Teutons there had been before in the woods of Germany; it is yet a disputed question whether the Gothic should be regarded as the prototype of Teutonic or as a separate branch of the same family. The Teutonic is divided into the Eastern—the Scandinavian class—and the Western, which again is sub-divided into (1) Frisian, Saxon; (2) Frankish, Hessian, Thuringian; (3) Allemannian, Bavarian. The Old Scandinavian in its almost ancient purity is still spoken and written by the Icelanders; while in a more developed state it has become the language of the Swedes. The Norman pirate was seldom at home and with his booty brought back German and French influences, and in course of time the Swedish language, shaded with a German construction and phraseology had found it necessary to form a literary language of its own—the Dano-Norwegian tongue.

The Frisian and Saxon gave the Nieder-deutsch, the Frankish, Hessian, and Thuringian, the Mittel-deutsch and the Alemannian and Bavarian the Ober-deutsch. The Mittel-deutsch went through the successive changes of Alt-hoch-deutsch, Mittel-hoch-deutsch and Neu-hoch-deutsch, in which form it is the literary mean of the savant and the vernacular of the educated classes. The Frisian and Saxon in the neighborhood of Celt and Briton, and under the influence of Norman and Norman-French, has become the English language.

The English language has broken down all walls and avenues in its grammar, mutilated the bodies of words and left only the trunks of them; it has a code of vowels and consonants which are pre-eminently adapted for "spitting, and spluttering," or as some say, to be chirped by sparrows—and still it is the most wonderful in the labyrinth of the Aryan tongues. It has more people under its sway than any other, and has produced a variety of literature such as no other on earth can show. It has ransacked all recesses of human knowledge and feelings, and by dint of its terse and energetic character become the foremost of them all. What its position in the future will be is hard to say; let us hope that it will add much to the unification of the present Babel of tongues and reduce them to a number of worthy representatives of the Aryan speech.

II.

I have given a succinct history of the Aryan languages, as they appear on the scene of Aryan countries to the historical, or scientific, student in their life, development and ramifications, and shown how they were succeeded by their more intense vernaculars, in endless variety in Europe, Asia, and America. We can from the vast material of literary languages re-construct with an exactness befitting my purpose the original Aryan; now my purpose is to follow up the tendencies of the languages to differ from their mother-tongue, to explain the course they have been taking, and to forecast the probable future of these languages; for what historian is so deliberate and cold-blooded as to leave out his favorite idea about the destiny of the people, the state, the science, whose vicissitudes he is delineating?

The organic part of the language is the action word, the noun, the pronoun and the structure of the sentence, and it is here that we are mainly to look for the degree of relationship between the different languages and their connection with the Aryan.

The action-word in Aryan was composed of the uninflected part (which for shortness sake I shall denote by the term *verb*) and the pronominal ending. A rudiment of a past and future tense, and also of a conditional mood existed, but these were not stable enough to influence

alike, permanently, the various descendants. Thus many languages had to form their tenses themselves. The past was composed of the verb, the word corresponding with *have* and the pronominal ending; the future was less certain and coalesced either with *have* or with *be*. The pronominal endings lost their independent meaning, and were regarded as necessary appendices to the action-word. The past tense, not being sufficiently well established, the Aryans stressed the main part of the verb, as little children do when they refer to events recently or long since past. This is all we can say with certainty about the Aryan action-word. Let us look now to the respective construction of the action-word in early languages.

The last part of *luomen*, *amamus*, *buailmid*, is physiologically the same; even such apparently diverging endings as in *henti*, *amant*, *luousi*, *buailed*, are identical, every one accepting a different shape under the influence of phonetic laws. Reduplication in the past tenses of some languages and internal change in others, are what I have denominated as *stress* in Aryan. The Greek *lelukasi* equals *stress* plus *verb*, *ex* plus *si; amavit* equals *am* plus *hab* plus *it*. The development of the future belongs separately to every family. Later on, the tenses became more and more conventional. The original composition was lost sight of entirely; pronouns were being added in the beginning; and still later, as in the case of the Romance, the corrupted old forms are being pushed out by original compositions, analogous to the primary building up of the Aryan.

Torceaun, in his Roumanian grammar, after enumerating the Imperfect, Perfect, and Pluperfect Simple and giving their paradigms, says:

"These perfect and pluperfect tenses are *frequently* used in narration, whereas in conversation in speaking of past time the following compound perfect is used: *eu am arat* 'I have ploughed.' Analagous compounds are: *Ich habe geschrieben*, *Oeilo Bailei*, I shall throw.

Grammatically and, may be, also logically the Aryans conceived the adjective, the pronoun and the substantive as existences, as objects; declension acquired shape before the distribution of the families and was the result of a loss of meaning of specifics, particles and prepositions which were added to the word to form the needed relation. The oldest languages have so many things in common in the formation of feminines, and in declensions, that there is no doubt of the common derivation of their forms from the mother-tongue. The tendancy of the old languages to make *a* prominent in the feminine and *m*, or a nasal *n*, or a vowel in the accusative, press through in the most of the modern languages. In course of time the ease-endings became fewer and fewer until they disappeared in the most, so that prepositions had to be put in front of the word to be affected. Instead of *amici* we have *del amigo*, in-

stead of *godrar* and *godri* and *godum* we have *of the man*, *to the man*, *from the man*, *with the man*, and this shows that English has lost all respect for and sense of the rich nomenclature of Aryan grammar. The order of the sentence in Aryan seems to have been originally the inverted, that is, the verb was followed by its defining subject, the attribute followed the noun and the participle defining the relation stood after them. But not long previous to the distribution of the Aryan languages, when the cumbersome grammatical structure demanded greater freedom, the order in the sentence may have been promiscuous. In the most modern languages the order is direct and begins with the subject and ends with the object.

Thus we see that from a comparatively simple construction the Aryan tongue was modified to complex grammars in the classical languages; these were going up hill, until reaching the summit, a descent on the other side began. The languages are moulding themselves back into simple shapes with auxiliary verbs to express tenses, with pronouns to indicate persons, with prepositions to form relations. What will be the end of it? When the languages will have simplified so as to have reached the nearest possible approach to early Aryan form, there will be a struggle between them until the more powerful, the one which is spoken by a greater populace, will substitute the weaker, and then a few new centers will be formed for the development of those few families.

We see how in America the English language is undermining and exterminating the other Teutonic languages; the contact of the English with the German, the Danish, the Dutch, has been ominous to the latter. Where are the Knickerbockers of New York, the Swedes of Delaware? The Spanish has substituted the finer but more complicated Indian languages of the Mexicans and the Peruvians and only meets resistance from the indomitable Maya. The English has crowded out the Spanish of the Pacific coast, and before long New Mexico and Arizona will be Spanish only in tradition.

The war has begun, and the simplest language, the most adapted to every day wants, will some day remain the only important inheritor of the legacy of a people that founded *Arya Varta*, the land of the just.

HERBERT SPENCER'S ESSAY ON RELIGION.*

It was mere intellectual error which led Augustine and Calvin to begin by applying the physical law of Causality to the moral nature of man, and to end by defining the divine Predestination as *Decretum Horribile*,—which represents God as a tyrant who arbitrarily ordains both

*Religion: A Retrospect and Prospect. By Herbert Spencer.

sin and its punishment and Righteousness and its reward; and is utterly oblivious of the simple truth

"That God's first use of Sovereignty
Hath been to make our fellow-men
With all his own vast freedom Free."

For they strove to bind the moral nature by a law which pertains only to the physical universe, and which ceases to exist in the presence of Will, human or divine, just as Gravitation, Chemical Affinity, or any other so-called "Natural Laws" might cease, or reverse, their action if material things were once endowed with Will: so that water might will to flow "up stream," and solid bodies might will to fall from, rather than towards the center of the earth.

This ancient intellectual error has been repeated, in a far more pitiable and inexcusable form, by Mr. Herbert Spencer in a careful essay entitled "Religion: A Retrospect and Prospect," which appeared in *The Nineteenth Century* for January 1884, and was republished in *The Popular Science Monthly*. For Mr. Spencer, who is one of the chief apostles of the atheistic creed of Agnosticism, (like all his tribe) seeks to bind moral or spiritual truths by physical laws; a process as utterly unscientific as would be the attempt to determine the fauna and flora of any designated region by an examination of the religious notions of its inhabitants.

In the article named he first assumes the absolute verity of the physical law of Evolution, assumes that this law is as applicable to religious conceptions as to material existences, and next assumes that the facts manifested in the course of the "development" of Religion demonstrate the evolution of our Theism from an exceedingly thin and intangible protoplasm of ghostism, as the following quotations show: "How do these ideas concerning the supernatural evolve out of ideas concerning the natural? The transition cannot be sudden; and an account of the genesis of religion must begin by describing the steps through which the transition takes place.

"The ghost-theory exhibits these steps quite clearly. We are shown by it that the mental differentiation of invisible and intangible beings from visible and tangible beings progresses slowly and unobtrusively. In the fact that the other-self, supposed to wander in dreams, is believed to have actually done and seen whatever was dreamed—in the fact that the other-self when going away at death, but expected presently to return, is conceived as a double, equally material with the original: we see that the supernatural agent in its primitive form diverges very little from the natural agent—is simply the original man with some added powers of going about secretly and doing good or evil. And the fact that when the double of the dead man ceases to be dreamed about by those who knew him, his non-appearance in dreams is held to imply that he is finally dead, shows that these earliest supernatural agents are con-

ceived as having but a temporary existence: *the first tendencies to a permanent consciousness of the supernatural prove abortive.*

"In many cases no higher differentiation is reached. * * * Thus the Unkulunkulu, or old-old one, of the Zulus, the father of the race, is regarded as finally or completely dead. * * * But with habitual wars, * * * with the compoundings of small societies into greater ones, * * * with the multiplying gradations of power among living men, arises the conception of multiplying gradations of power among their ghosts. Thus in course of time are formed the conceptions of the great ghosts or gods, the more numerous secondary ghosts or demigods, and so on downwards—a Pantheon: there being still, however, no essential distinction of kind: as we see in the calling of ordinary ghosts *manas*-gods by the Romans and *elohim* by the Hebrews. * * * With advancing civilization the divergence of the supernatural being from the natural being becomes more decided. There is nothing to check the gradual de-materialization of the ghost and of the god; and this dematerialization is invisibly furthered in the effort to reach consistent ideas of supernatural action: the god ceases to be tangible, and later he ceases to be visible or tangible. Along with this differentiation of physical attributes from those of humanity, there goes on more slowly the differentiation of mental attributes, until the harsher features are differentiated out of existence, and "divine love, divine forgiveness, divine mercy, are now the characteristics enlarged upon."

After tracing the supposititious influences of the law of Evolution through all the anthropomorphic conceptions of Deity, and assuming that the law applies to God, (as well as to man's notions of him) the philosopher continues: "Thus recognizing the fact that in the primitive human mind *there exists neither religious idea nor religious sentiment*, we find that in the course of social evolution and the evolution of intelligence accompanying it, there are generated both the ideas and sentiments which we distinguish as religious: and that *through a process of causation clearly traceable, they traverse those stages which have brought them, among civilized races, to this present form.*"

This is perhaps the highest and most recent utterance of agnosticism in regard to God; and it gives us not even a Zulu-land "Unkulunkulu" to worship: and this is just what human philosophy naturally "differentiates" by the application of physical laws to moral questions.

It must be palpable that this attempt to evolve the idea of God from "the Ghost theory," rests primarily and confessedly on the assumption that "man" was once such a hopeless idiot as to believe that he had "actually done and seen whatever was dreamed": *i. e.* that man did not know that he might dream when he

was sleeping, and, therefore, believed his dreams to be veritable facts "done and seen."

The basis of the whole thing is false in fact: for there never was a time when man did not have sense enough to know when he had been dreaming. Nor is it any more true in fact that mankind ever believed that each individual had an "other-self" that "when going away at death, but expected presently to return, is conceived as a double equally material with the original." The Zulus may have had some such notion, as they are very "agnostic" tribes; but mankind never did. If it were true that man possessed this "double," or believed that he possessed it, Mr. Spencer did not know "the fact that when the double of the dead man ceases to be dreamed about by those who knew him, he is finally dead"; for while many a man has justly believed that his spirit survives the death of his body, and that his own and the spirits of other men might "return" (as many beyond any sort of reasonable doubt have done), the only reason for his "non-appearance in dreams" may be the fact that the separated spirit may have passed into conditions which render it impossible or unpleasant for it "to return"; —it may have acquired "a spiritual body," or it may have finally abandoned the hope of doing so; and in either case, might voluntarily, or compulsorily, have severed all connections with men "in the flesh." For it is abolutely certain that the first necessary work of a Soul (Life, *Psyke*) when quickened by conjunction with a Spirit (*Pneuma*) is to begin the work of erecting a natural body for itself and its conjoined spirit, as it does in the womb by the assimilation of natural aliment, primarily from the blood of the mother, under conditions of which we know something; and we may be very sure that the same soul separated from the body will seek to create a spiritual form for itself and its conjoined spirit by the assimilation of spiritual aliment, of which we know little, under conditions of which we know even less. And these conjectures are certainly as reasonable and "scientific" as any which Mr. Spencer has suggested. For what authority is there for declaring that a belief in ghosts, based upon the alleged fact that men were once so silly as to have believed themselves "to have actually done and seen whatever was dreamed," gave rise to faith in immortality, and finally to faith in one great Immortal, rather than to say that a prior belief in immortality gave rise to a belief in ghosts? Is it more easy to conceive that man believed in ghosts because they first believed that spirits which had left the body had visibly returned, or because having a prior belief in the immortality of the spirit, they thought it natural that the separated spirit would revisit formerly well known scenes? However this may be, it is not probable that belief in ghosts originated in the impossible fact that

man believed in dreams as true; and perhaps we would come nearer the truth by declaring that both faiths would have been impossible to man, unless the facts existed, to-wit, that the spirit survives the body, and that it sometimes "returns"; otherwise there is nothing from which the belief could be "evolved."

It is thus made plain that the doctrine of evolution is incompetent to account for belief in the supernatural without falsely assuming it to be true that man is silly enough to receive as a fact that the "other-self" *is* "supposed to wander in dreams" and "*is* believed to have actually done and seen whatever was dreamed:" and equally plain that when Mr. Spencer asks "How do these ideas concerning the supernatural evolve out of ideas concerning the natural"? the answer ought to be that they do not so "evolve" at all, and are ideas that are in the very essence of them of an entirely different kind, and that came from another sphere of ideas altogether. For not only is it true that the attempt to apply the physical law of evolution to God (or even to anthropomorphic conceptions of him) is a mere intellectual abortion such as Augustine and Calvin perpetrated in their efforts to subject the moral nature to the law of Causality, but it belies the history of the human race.

Let us examine this assertion briefly.

The Agnostics denominate God "the Unknowable," "the Unthinkable," and by other appellations designed to express the idea that the thing spoken of is utterly beyond the range of human thought: "an Ultimate Reality transcending human thought." So far as our mere intelligence is concerned, the agnostics are unquestionably right. Jesus Christ expressed and repeatedly taught that God is "Unknowable, Unthinkable" to human intelligence; and that his personal existence would have been a blank to us forever if He had not chosen to reveal Himself to man; but the assumption of the agnostics (however essential to the statements of their atheistic creed) that our present conceptions of Deity are only the evolution or development of primitive crude notions on the subject, *is utterly false in fact:* for the simple fact is that the original faith of the primitive races of mankind was an absolutely true Theism, of which the Athanasian creed itself is a mere perversion; so that, the original Faith, more perfect at the genesis of it than it generally is today, must have been a Divine Revelation and not an "evolution" or "development" of anything whatever. It seems to be a thing utterly impertinent to the purpose to cite the idolatrous notions of comparatively modern nations like the Greek, Romans and Zulus (with Unkulunkulu at their head) upon such a question, for it must be well known that Egypt was wrinkled with age, and that the Israelites, the Chinese, and the Indians, were each "a people" centuries before these modern na-

tions existed; and he might equally well know that the original faith of these primitive races was a pure Theism—faith in one dual God, a double Being, self-existent, that was sometime to become manifested to mankind by the generation and incarnation of a son; and that this primitive, pure Theism preceded all forms of polytheism by countless centuries; and that idolatry became possible only by the degradation of the original faith.

This primitive faith was expressed in China by the double-name Chang-Eng; and after the Chinese had vainly waited for centuries for the earthly manifestation of the one dual Deity, and faith began to fail, they first, perhaps, degraded the original Theism by considering the Igneous and Aqueous principles of nature to be the source and origin of all things, and then learned to believe that Man himself was the earthly manifestation of God, and, hence, they began to pay divine honors to their ancestors, and to "pot" and worship the bones of their fathers, a fact that is inexplicable except on the supposition that they believed Man to be the earthly manifestation.

So in India the original faith in one dual Being self-existent, as set forth in the earliest Rig-veda, was expressed by the double name Indra-Agni, and as faith began to decline they construed the divine names to signify Solar light and vapor, and began to believe that Buddha was the earthly manifestation of the one Supreme God; and afterwards Vishnoo, Siva, Brahm, and countless other mythical deities intruded into the darkened world of faith.

So, and more clearly, in Egypt the revealed name of God was Ra, and his consort, the feminine element of the Dual Being self-existent, was a female Ra, and never any created being, but essentially one with himself, consubstantial, *omoouuios;* and this one dual, double-sexed deity was to be made manifest to man by the generation of a Son, and his birth into the world. When the coming of this divine Son had been long delayed, and faith in the original Revelation grew wavering, the priests began to search for him through earth and heaven. The original conception of the Ra-ra God and a promised but unknown and nameless Son, degenerated into the mere myth of Hesiri-Hes (which Herodotus introduced to the Greeks as Osiris-Isis) and a Son called Horus. Yet it seems to be true that the priests long regarded Hesiri-Hes and Horus as a myth only, and as symbolical of God and his Son; and it undoubtedly is true that while the Egyptians worshipped God by different names at different times and places, they always carefully maintained the essential idea of a dual God made a Triad by the generation and birth of a Son. The primitive formula of faith was the Ra-ra, dual God, and an unknown Son: after that the myth of Hesiri Hes Horus: then the transformation of this myth by belief in it as

a fact instead of as a symbol: then the giving of other names to the same Triad in other temples: then as the degradation of the religious idea proceeded, the idolatrous notion that the Son whom they had vainly awaited in the form of man, might come into the world as a sacred brute: then the deification of the sacred Bull Apis, and even of inanimate things as the Nile. The word Hapi which was applied to the bull-god and to the Nile, in the Hieratic speech of Egypt signifies "the Hidden," the Concealed," and undoubiedly meant to embody their priestly knowledge that the son whose manifestation was to make a Triad of the Ra-ra God, was yet "hidden," "concealed," like the undiscovered sources of the Nile and like the Divinity whom they vainly hoped some Apis might beget.

These facts and others of equal significance, leave no doubt that the original faith of the primitive races was a pure Theism, and that the polytheistic and idolatrous notions out of which he seeks to "evolve" the idea of the supernatural, was the degradation of the faith which was revealed in perfect strength and purity, and never evolved out of anything human or earthly, even as Paul said to twenty centuries ago.

[TO BE CONTINUED.]

LIFE IN UNCONSCIOUSNESS.

It is not intended to examine in this paper the metaphysical doctrines of any school of philosophy, however suggestive the title may be of teleological speculations. The era for mental gymnastics, for subjective ratiocination, is fast passing away; and marvellous as the speculations of metaphysicians may be in the laudable effort to discover a First Cause, we find now so much in the phenomenal world to engage attention that there is little to attract truth-seekers into fields beyond experience. Having assured us that there is a First Cause and that it is Infinite and Absolute, Philosophy should rest on its laurels without destroying its own edifice by attempting to define Infinity and limit Absolute Being. The old fashioned lines of Pope are applicable here:

> "Presume not God to scan;
> The proper study of mankind is man."

The subject to be discussed in this paper has been pressed on my attention from many directions and through very diverse phenomena. The facts which gave it birth are many of them old and well known even to the popular apprehension. Those that possess any novelty are attested by the universal voice of science and are no longer occult, even to the casual enquirer. That my use of these facts may be clumsy and inadequate I do not doubt; but that in the hands of a master, such as may

arise hereafter, they will serve to rationalize much of life's mysteries that still vibrate to superstitious chords and remove a thousand obstructions to man's progress from animalism to the pure heights of reason and intellectual life, I firmly believe.

In the evolution of life there is a progress in two directions: (1) toward a specialization of physical functions and (2) toward the automatic action of these functions. Without the first the second could not exist, and *vice versa*.

A great writer, Thomas Carlyle, in a well known book finely says that man's "collective stock of Handcrafts, the whole faculty he has acquired of manipulating nature—all these things, as indispensable and priceless as they are, cannot in any way be fixed under lock and key, but must flit, spirit-like, on impalpable vehicles from father to son: if you demand sight of them they are nowhere to be met with." Here is a shadowy perception of the fact that all craft—all use of function—all expenditure of force—are gravitating toward automatism. The "stock of handicraft" which seems so mysteriously transmitted from one generation to another we now know is simply the stored up training of the race; training which in time becomes as purely automatic in its manifestations as the beating of the heart or the motions of the diaphragm. It is a recognition of the truth, which cannot be stated too broadly, that the higher life must be the result of organization,—the consequence of the acquisition, not of of new faculties or senses or functions, but of the power to so exercise those we now possess that their use will not be slow and painful. In modern books we read constantly of "organized memory." This expression has become a sort of new abracadabra which is lugged in to explain every difficulty in the path of the student. If it is asked how is it that I write the words upon this page without conscious reference to the letters that compose them? the answer would be, "organized memory." If a musician, thoroughly acquainted with his instrument, should curiously ask how it is he can, without conscious volition, strike the right note in the dark, or play a difficult piece at first sight, the answer is, "organized memory," That organized memory exists is part of my proposition and memory when it becomes organized must be exercised unconsciously. But all expertness cannot be explained by this principle. In the labor of writing many things join together to produce the result. Because we do not have to consider how a word is formed in order to write it, is not a reason for saying that the letters are unconsciously in our memory. I don't believe they are. I believe that, having learned how to form a word, that word becomes a fundamental acquisition which the operations of the mind give off at the end of the pen just as though an automaton held it and the impulse was a crank and a

train of wheels. The thought seeking expression adopts the word, itself an acquisition, and whenever the thought arises the word comes with it, without calling up one by one the phonetic elements it contains. Carried a step further the inaudible thought having become an audible but invisible word this invisible word becomes a visible sign of speech; and now when the thought arises the word comes also, but not alone; with it comes the written sign. No one will contend that in arranging the apparatus of vocal speech to utter a word, we consciously pay any heed to the phonetic elements it contains: no more do we consider how to form a written word. The vocal word becomes no less, no more, an organized craft than the written word. This illustration is applicable throughout the entire range of mental and physical training. Almost all our knowledge is organized and, hence, unconscious, knowledge. Though experience and precept teach us, their teachings must become organized—must be unconsciously retained in the brain, nervous-centers and muscles so systemetized that they will respond to objective, as well as sub jective, stimulation without going through a slow and painful, or any sort of, mnemonic process.

As the key of a piano when struck gives back a certain, unvarying note so do localized cells of the brain, when stimulated into activity, with the same unvarying and unconscious habit, return a definite response. But the real dispute does not depend on novel propositions to reach an elucidation. We are aware that the whole process of nutrition, as well as disorganization, is accomplished unconsciously. Place food in the mouth for instance: the salivary glands at once become active—is there a conscious message sent them from the brain? The act of swallowing, at first possibly conscious, ceases to be so when the food enters the aesophagus—indeed from the time it passes over the automatic valve that prevents its entrance into the larynx. When the food enters the stomach, a whole train of automatic processes sets in. Movements of the stomach, more or less violent, commence, which keep the food in constant motion; the peptic fluid pours from its glands in quantities graduated by the work to be done; and until this work is done a valve that almost seems to possess perceptive faculties and reason, prevents the food from leaving the stomach to perform its office of nutrition. When the food is thoroughly digested this valve opens and other automatic processes, not less ingenious and wonderful, carry the digested food through all the stages necessary for its entrance into the circulation. And here is met another series of automatic processes. This red current of life is beyond the reach of the will in its whole scope of action and office. Its ducts, its valves, its movements, its entrance into the heart charged with impurities from the waste of tissue, its pas-

sage to the lungs and other viscera for purification and oxydation, its return to the heart and dissemination through the arteries into all parts of the body, to go again and again through the same process,—all these instrumentalities and operations are automatic,—belong to the unconscious side of man; and all are instances of specialization and organization.

It is said that in the lowest forms of life the senses do not exist at all save in the form of a dull sense of touch; that this sense, at first confined to the office of recognizing chemical action and violent and abnormal shocks, became at last more delicate; began to respond to fainter and fainter impressions from surrounding objects; specialized itself first into one sense and then another, as the various etherial forms of matter constantly beat upon it for recognition, until there was added to touch the finer and yet finer senses of taste, smell, hearing and sight. Here is specialization taking its accustomed form and with it comes its concomitant, organization. For while we can prevent these senses from acting at all, we cannot control them when in healthy action, from returning their genuine impressions by any exercise of the will.

In truth we find that throughout the entire range of human thought and action, the process that we call education and organization is merely a progress toward automatism. No matter in what direction human purpose may be guided, it is found that its achievements are most peurile and unworthy so long as they are reached by trivial and tentative processes. Darwin, recognizing in a dim sort of way this general truth, so far as it concerned zoology, and attempting to organize the world's knowledge of animated nature, states that he studied for five years before speculating on the subject. That is, he attempted to place all the facts in this department of science under the dominion of Will so that they should become a part of his mind and, as constantly accessible as any other so-called natural mental furniture, such as space, time, etc.

It is these slow and tedious processes by which knowledge is gained that must be dispensed with. Knowledge of phenomena must become congenital like the senses; handicraft must indeed descend from father to son "on impalpable wings" like the functions of the viscera, before man can reach the highest place in nature. This has been the genius of his progress; organization, specialization, has led him over the tremenduous chasm from Amoeba to Man and must lead him onward still to the lofty existence wherein there must be a total unconsciousness of the phenomenal world; wherein all physical stimulations will produce action and reaction as far removed from apprehension and control of the Will as the worm-like motions of the intestines.

Now what is this process of organ-

ization but a constant and progressive abnegation of the Will so far as the trivialities of its growth are concerned? With each step taken in education the Will is relieved from primary duties. When the child learns to write without *willing* anything more than the production of the word or sentence in his mind, disregarding all questions of orthography or calligraphy, (which have become organized and need not be thought of) he has reached, by a very slow and laborious path, a stage which the man of the future will stand upon at birth.

And this brings me to the last point of my topic: Is the abnegation of Will a step to higher intellection? I believe it is. So long as an effort of will is required to direct the operations of the mind or body there must be difficulty, imperfection, delay. Once educated to perform its offices without conscious interruption, the brain will operate as automatically and certainly along purely mental lines as it now does in directing the sympathetic nervous system. Not that this abnegation of the Will can ever be real; it will be advanced to more gigantic offices. It will no longer attend to the minutiæ of things. Here and there it will set a thousand wheels in motion; and, like a god, wait for the result. The Man that I see springing from the long train of evolutionary processes will need no formal logic, no machinery of ratiocination. He will not need to be taught the multiplication table; he will not need to constantly waste life by verifying knowledge. Instead of having the body dominate over the intellect the mind will dominate over the body; but over all, as the *deus ex machina*, a gigantic and imperturable Will shall direct the course, though it may not restrain or accellerate the operations of the mind and body. Thus consciousness will be confined to purely supraphysical regions. Existence, as we now know it, will become unconscious and above and beyond the sphere of present existence, man will discover and occupy a new world more wonderful and more unexpected than that which gratified the eyes of a Columbus.

HYPNOTISM.

Hypnotism, or mesmerism, up to the present time, seems to have been looked upon as a scientific curiosity rather than as a legitimate subject for scientific investigation. The obscurity lingering around its anatomical basis, or, rather the pathological changes causing it, is such that it is extremely difficult to give a rational account of its phenomena. We can know nothing of the mystery called mind apart from its connection with matter. That it is a secretion of the brain, in the sense that bile is a se-

cretion of the liver, or mucus a secretion of a membrane, is not yet proved, and the analogy does not hold fairly good; for bile and mucus are substances which we can analyze, whereas thought is intangible. Yet for every change in the current of thought we are forced to conclude that there is some change in the instrument thinking. These changes can be produced in many ways. They can come from direct injury, from chemical action, from derangements of nutrition affecting the quality of the blood, from increase or diminution of the blood supply, from long continued over exertion. It is easy to see that if any part of the brain is over-stimulated, as it would be by an increased amount of blood, its action would be increased. There are many things, going to show too that the circulation can be increased in certain portions of the brain and at the same time diminished in others. This is supposed to be effected through the the sympathetic nerves, sometimes called the vaso-motors. Any irritation of the sympathetics causes a contraction of the muscular coats of the arteries, or arterioles, which lessens their size, and it is quite easy to see that as this irritation is limited or extended to different parts of the sympathetics the blood supply of the different organs will be varied. There are many abnormal states of the brain that we are forced to account for upon these grounds, states whose symptoms are histeria, somnambulism, trance, etc. From the nature of the case we cannot demonstrate these things experimentally, as we can some others, for we cannot cut into the brain or in any way expose it to observation while these processes are going on ; and if we irritate the vaso-motor nerves artificially we do not seem to have the means of limiting the range of irritation at will. But always, in hysteria, there is either hyperæsthesia with an increased, or anæsthesia with a diminished, flow of blood to other parts of the body ; so that it would seem as if the relation was one of cause and effect. From analogy it is fair to argue then that the same condition obtains in the brain, and if we apply the same terms to the brain as to the nerves of feeling, we have hyperæsthesias of the special nerves, as sight, hearing, etc., going to the extent of halucinations, or anæsthesias going to the extent of temporary deafness, blindness, etc.

The phenomena of hypnotism, or mesmerism, as it is commonly called, from Mesmer, the man who first brought it into existence, are, in reality, the same as those seen in other mental states that come on naturally in certain persons. The apparent difference arises from the fact that mesmerism is, in general, artificially induced and the person mesmerized is supposed to be entirely under the will of the operator. This, however, is a misconception, for at most the operator simply puts the person in condition to mesmerize himself, and then he is at the mercy of whatever impressions make themselves most

prominent. In the present state of our knowledge regarding the functions of different brain tracts it is exceedingly difficult to know how this can be done. From an analysis of hypnotic phenomena it would seem that in the main they consist of an abolition of will power, leaving the man to obey reflex impulse like a machine. A reflex impulse may be obeyed consciously or unconsciously. In any event it is simply the response that a nerve cell gives to a stimulus. If there is no consciousness present, we say we have no will. For in some way our philosophy has bound up our consciousness and will and responsibility in accordance with the dictates of theology and it is exceedingly difficult to unravel the knot. We may well ask if after all the will is not a higher kind of reflex responding to stimuli from brain cells that perform those processes which we call judgments. According to our present knowledge, the will is connected with a certain portion of the brain in the same way that speech is, and if this portion of the brain is destroyed, the will or at least the power of exercising it is destroyed. Diminish the blood supply in this particular portion of the brain until there is not sufficient to provoke its activity, and let the supply remain normal in the rest of the brain and you have one kind of automatism. The arrangement of blood vessels in the brain, is such however, that we cannot suppose this to be done without affecting other portions of it at the same time, and herein lies the difficulty of explaining some of the phenomena. We do not know what portions of the brain give rise to the phenomenon that we call consciousness. If pressure be made on almost any part of the anterior portions of the brain it produces unconsciousness, and when it is taken away conscious returnsness. That is all we know. A certain modification of consciousness takes place in the hypnotic state, and this may be due to a variation in the same blood supply that irrigates the tracts of brain habited by the will.

Now what is done in producing hypnotism?

1st. The attention is fixed upon some object that tires the eyes. This seems to be very necessary in subjects that have not already undergone the process. If the object is placed so that the axes of the eyes are somewhat inclined to each other a strain is brought upon the occular muscles which finally results in weariness. An unusual exertion in any part means an increased blood supply, but if carried beyond a certain point, we lose, for a time, the power of exerting the organ. This happens with the eye. Gradually everything disappears except the article looked at; this loses its brightness; becomes black; the blood distribution is disturbed; the hypnosis commences, the pupil gradually expands.

Next, if it is mesmeric sleep that you want, approach the eyes suddenly with some object as if about to

put them out and they will close. Tell the subject then that he cannot open them and he cannot. He has not will power enough to examine your assertion. He takes it for granted. There seems to be no inclination to test the veracity of any assertion and the man acts as if any impression made upon him were an actual fact. Among the phenomena developed in this state, there are many difficult to explain upon any hypothesis. Certain persons very ordinary in their natural condition become quite brilliant when hypnotized. Persons in a trance state have talked with an abnormal eloquence; others ignorant of music have suddenly developed a wonderful talent in this direction. A young Frenchman while mesmerized could solve difficult problems in mathematics and in his waking state knew very little of mathematics. Such things pass for inspiration. They certainly show a hyperæsthesia of certain regions of cerebration. But how explain the sudden acquisition of something not before in consciousness? True enough mathematics is not a science in the sense that other sciences are. It is more a kind of language, a knowledge of relations which seem to exist in the very nature of things and perhaps exists in us as well. Some persons seem to grasp it intuitively and in some very remarkable cases the power of calculation is joined to a mental weakness almost idiotic. By these persons problems appear to be solved by processes more direct than those found in mathematical treatises, as if a portion of the nerve paths used in calculation, a portion of the route traveled by the nerve power, had been cut off as useless. What the processes are by which these abnormal results are reached in hypnotic states, of course we do not know. We might suppose that the hyperæsthesia has aroused an ancestral memory, that it has caused the nerve force to traverse paths marked out by inheritance but not developed. So we might say in regard to music trance speaking, or any of the extraordinary powers which are so suddenly conferred. As far as I can discover these powers do not transcend what we might naturally expect from the person himself if he had undergone a process of training, and there are no extraordinary manifestations except in the line of a man's natural talents.

It is very difficult to estimate the size of the grain of truth in these manifestations. In many cases there is a tendency to deceive and in the spectators a tendency to exaggerate. But if we look upon education as it is, simply as an unfolding, a co-ordinating of the powers that are in a man already and not as a pouring in of new material, it may be more readily explained how new co-ordinations can be suddenly brought about. If anything had been accomplished by hypnotism which was before unattainable to the race, if some class of problems could be

solved which had so far baffled the powers of the best of us, we might then be obliged to look outside for an explanation.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The thirty-fourth session of the association assembled under favorable auspices in the classical city of Ann Arbor, Michigan, on August 26th, 1885. Ann Arbor has an air of culture and refinement, and its selection by the standing committee as a place of meeting, proved to be wise, and most satisfactory to all who attended.

The white walls of the University, the great pillars of the porch, together with the stately avenues of trees on the college campus, seemed to bid us welcome, and to impress the senses with the approach of a feast of intellect and a contest of thought. And the good people of Ann Arbor gave us receptions and entertainments worthy the fair fame of their beautiful city.

The address of the retiring President J. P. Lesley exhibited the results of mature thought, and was listened to with marked attention by an appreciative audience. From a multitude of good things we quote: "The age of romance in science is part of the forgotten past. The New World has grown grey-haired in fifty years, intolerant of the irresponsibility, the sportiveness, the poetry, the music, the superstitions, the affections of its youth; dealing only in hard facts, and in their causes and consequences; weighing and measuring all things; collating, comparing, and classifying; insisting upon investigation at all points; formulating rigid laws; scoffing at the unseen and unknowable; and transmitting the fear of God and the hope of heaven into a zeal for the exact determination of the units of force, and a confident expectation that railroads will soon traverse all the unoccupied regions of the earth, and malleable steel replace wood in the mechanic arts."

But Prof. Lesley originated an expression which will become classical—"dead-work." He said: "To describe dead-work is to narrate all those portions of our work which consume the most time, give the most trouble, require the greatest patience and endurance, and seem to produce the most insignificant results. It comprises the collection, collation, comparison and adjustment, the elimination, correction and re-selection, the calculation and representation—in a word, the first, second and third handling of our data in any branch of human learning—wholly perfunctory, preparatory, and mechanical, wholly tentative, experimental, and defensive,—without which it is dangerous to proceed a single stage into reasoning on the unknown, and futile to imagine that we can advance

in science ourselves, or assist in its advancement in the world."

Section A was favored with a profound mathematical paper on "The effect upon the earth's velocity produced by small bodies passing near it," by Prof. H. A. Newton, president of the Association. This problem is one of great difficulty, and requires the highest mathematical skill in its solution. But it was solved completely. The master mind penetrated all hidden labyrinths in computation, and satisfied the most formidable equations. Prof. Newton demonstrated these theorems in gravitational astronomy:

"A. If a cylindrical stream of small bodies evenly distributed and all moving in the same direction with common velocity shall move past the earth, supposed to be in the axis of the cylinder, the small bodies by the law of universal gravitation shall communicate to the earth a velocity along the axis in each unit of time:

(1) That shall be proportional to the density of the group:

(2) That shall decrease as the velocity increases, varying very nearly inversely as the square of the velocity:

(3) That shall increase with the radius of the cylinder, and be proportional to the logarithm of that radius, measured by a unit that differs from the earth's radius by a small quantity which is a functiou of the velocity."—*Newton's Abstract.*

The professor then proved that if this cylindric meteoric stream had an infinite radius, the velocity imparted to the earth by its passage would be infinite; but if its radius be comparable with ordinary stellar distances then motion so communicated to the earth would not be large. It was then shown that the cylinder of meteors even if of infinite diameter, and moving with a velocity *greater* than that of the earth, there would result an exceedingly minute acceleration of the earth's motion! If, however, the velocity of the meteors was *less* than that of the earth, the effect on the motion of the earth, would depend on the absolute velocity of the bodies, an assumed extent of the stream, both producing a minute retardation, yet the "effect is much too small to be detected by observation."

It was likewise proven that impact of meteoroids on the Moon can only increase its motion by "an exceedingly minute fraction of the Moon's observed acceleration." The chief result of the investigation is that the siderial year will not be lengthened or shortened by impact or flight of small cosmical masses.

Prof. Wm. Harkness, U. S. N., then presented a technical paper on the "Flexure of transit instruments," and showed how difficult it is to eliminate errors, since solid metal instruments are elastic enough to affect the line of collimation.

Prof. G. W. Hough, Dearborn Observatory, Chicago, then described his new printing chronography, which prints minutes, seconds and

hundredths of a second on paper scrolls, which next morning can be read off directly. The mechanism is driven by a storage battery of the Professor's own construction, having an electro-motive energy of six volts, and the whole thing was termed a "luxury" by the astronomer.

Prof. J. B. Webb next described a method he uses in transformation of polar co-ordinates.

And then came Prof. C. H. Rockwell, of Caroline Island eclipse fame, who gave us an elaborate explanation of the new astronomical instrument—the Almucantar. He placed on the black-board a series of observations on fundamental stars for latitude. These observations were of surprising accuracy considering the simplicity of the instrument which consists of a telescope furnished with circles, verniers and micrometer, all resting on a heavy base which floats in mercury. We scarcely know what Rockwell will do next; he is liable at any time to start on an expedition to the end of the world and even now is in the process of making up his mind to go to the Congo country to witness the total solar eclipse of August 28–9th, 1886.

A pleasing change was made at Ann Arbor, in that Sections A and B held alternate sessions, allowing the privilege of hearing discussions in both. In Section B, the proceedings were of great interest.

Prof. S. P. Langley during the last two years has made refined research with the bolometer on the infra-red portion of the spectrum of the sun. This close student peers into the innermost recesses of Nature and seeks the wave-lengths of that heat radiation sustaining life on the globe.

A drawing revealing immense extension to the sun's spectrum was shown, wherein the visible portion was represented by a band of colors two or three inches in length, while the invisible—as detected by the bolometer—extended seven or eight feet beyond; the Professor stating that if the light spectrum be drawn to any ordinary scale, then the heat spectrum would not fall within the room. Great questions are involved since the energy in the infra-red spectrum sustains life on the earth: and the inquiry was raised, are the wave-lengths of energy radiated from the earth the same as the wave-lengths received from the sun? Varied experiments were made at Alleghany Observatory, to answer the question, with the result that the wave-lengths of energy receding from the earth are twenty times longer than those received. It seems reasonable that in the near future physicists will find the reason why the temperature of the earth and its atmosphere is so much higher than that of outside space.

But, this addition to the hitherto known spectrum was only made possible by *perfect* rock salt prisms manufactured by Mr. J. A. Brashear, Pittsburg, Pa. The processes of their manufacture were explained by Mr. Brashear, who displayed elegant

specimens, while recounting the troubles met with in preparing absolutely plain surfaces. And it is with these prisms of salt that Prof. Langley makes unheard of discoveries in the infra-red. We quote Mr. Brashear's exact language: "The work Prof. Langley has done with the bolometer and rock-salt prisms on the spectra of some sources of invisible radiation, and in the recognition of hitherto unmeasured wave-lengths is most important. Suffice to say that if we place the value of the now known spectrum equal to one, his researches have revealed three-fifths of it."

We were impressed with the beauty of Prof. Rouland's diffraction gratings now made only by Mr. Brashear, who had a number on exhibition. And since spectroscopy is of such value in modern physics, we, at the risk of taking too much time, desire to note in detail these triumphs of genius and skill. We insert Mr. Bashear's own language as follows:

"The smallest grating—one inch—contains about fifteen thousand lines, and is estimated to be as powerful as a battery of twelve prisms. We have seen fourteen lines between the two D lines, and both the D lines double. This, of course, is out of all comparison with any prism spectroscope. The gratings are tested with a viewing telescope and collimator of six and three fourths inches aperture and seven feet focal length, probably the most powerful spectroscope in the world. And all gratings must stand this test before they are passed. The screw of the ruling engine is perhaps the most perfect mechanism ever made as the error of the length is less than half a mean wave-length of light. Though one of the most prominent European theoretical opticians declared it to be impossible to make a concave grating to give a perfect spectrum, Prof. Rowland demonstrated that it could be done. And now the work of these concave gratings is known all over the scientific world, especially in spectrum photography. When Thollon and Augstrom show seven or eight lines between the H lines in their standard maps, photographs taken by the aid of the large concave gratings show a hundred or more. And where the maps show no lines beyond the H group, one thousand are shown in the photographs up to wave-length thirty-seven, and hundreds may be counted beyond."

Surely the sun is surrounded by an absorptive atmosphere, which bids fair to be proven to be made up of all elements in a gaseous form, and if Newton's spirit can behold the actions of man on the earth, his soul must be filled with admiration at the advance of studies in the spectrum; while Fraunhoffer would be filled with amazement when viewing the multitude of lines rendered visible in the diffraction spectra of suns and nebulæ, telegraphic signals from the solitudes of space spelling out the names of the constituent materials of the most distant incandescent bodies.

Mr. Brashear then made a magnificent spectrum on the ceiling of the University by simply holding a grating in the sunlight shining through a window.

Prof. E. L. Nichols,—University of Kansas,—then presented a paper describing an elaborate series of experiments made with a spectro-photometer. He projected a spectrum of the sky, and composed it with spectra derived from light reflected from substances supposed to be white, such as magnesium carbonate, calcium sulphate, etc. Curves of results were shown and the data appeared to teach that the spectrum of a clear blue sky differs but little from spectra of white light or rather of light reflected from white bodies. It seemed impossible to escape the conclusion that the blue color of the sky is not really due to an excess of blue rays, but to a tendency of the retina to sensitiveness to blue or violet light. An apparent discrepancy in results of spectroscopic study seems to have arisen between Professors Langley and Nichols, which must be explained by further investigation. The scientific world knows that Langley went above nearly half the mass of the air on Mt. Whitney, armed with the spectroscope. From his report as delivered to the Royal Institution,—Science vol. V. No. 121, page 442, we quote: "I think we already begin to see that it is, at any rate conceivable that we *may* have been hitherto under a delusion about the true color of the sun, though of course this is not proving that we have been so. And it will at any rate, I hope, be evident that here is a question raised which ought to be settled; for the blueness of the sun if proven, evidently effects our present knowledge in many ways, and will modify our present views in optics, in meteorology, and in numerous other things;—in optics, because we should find that white light is *not* the sum of the sun's radiations, but only by those dregs of them which have filtered down to us." And on page 449, in speaking of his experiments on Mt. Whitney in building up curves representing solar energy, Langley says: "These have grown out of all proportion at the blue end, as you see by the outer dotted curve, and now we have attained by actual measurement that evidence which we sought, and by thus reproducing the spectrum outside the atmosphere, and then recombining the colors of like methods to those you have seen on the screen, we finally get the true color of the sun, which tends, broadly speaking, to blue."

It will be interesting to learn what decision of the questions here raised will eventually be made. Valuable papers were also presented in Section B, by Professors Carhart, Mendenhall ond Dolbear on subjects pertaining to electricity, while Mr. Clayton thought he had detected a law of change in barometric pressure and temperature.

Of the great number of papers read

in Section C, we mention one, that of E. H. and A. H. Cowles and C. F. Mabrey on an electric furnace for reducing ores of Aluminium. Very likely this furnace will revolutionize metallurgy, and mankind will derive much benefit if this metal Aluminium can be cheapened in price by electrical reduction. The ore is placed in the furnace between the electrodes of a dynamo, and is melted by the intense heat of the broken current.

This Aluminium question opens up several important possibilities, and the imagination readily conceives of an Aluminium steamer skimming across the Atlantic with increased velocity rendered attainable by the greatly reduced weight. And by another flight, we can imagine an airship of this light metal, hurrying to Europe, above the clouds, completely ignoring the ocean wave.

The Section of Geology was replete with contributions to our knowledge of the earth, notably by Professors Alexander Winchell, Orton, Williams, Claypole, Worthen and N. H. Winchell.

The Association was well entertained in the evening by an illustrated lecture on the proposed Tehuantepec ship railroad. The gigantic undertaking was fully explained by projection of lantern slides, and the details made clear. An immense car truck is to be rolled out upon a pontoon. Water is admitted and the whole sinks to the bottom. The ship is then brought directly over the car, when pumps exhaust the pontoon allowing air to enter and raise the whole mechanism, car, ship and all. The trucks and its mighty load is then hauled upon the railroad, which consists of six rails, making a road bed nearly forty feet wide. A steamship can be taken out of the ocean and placed on the track in thirty minutes; three sixty-five ton locomotives are able to haul the car and ship, the whole length of the railroad 134 miles, with a velocity of fifteen miles per hour. Really we are living in eventful times,—Langley is telling us all about the sun, the Cowles are solving the problem of wresting Aluminium from its refractory compounds, while the commercial unrest of man is about to break the isthmian barrier that has so long retarded that auspicious day—which is surely coming—when the nations of the earth will be as one.

Prof. E. S. Morse is President-elect, and Buffalo, N. Y. the place of next meeting.

"THE CRADLE OF THE HUMAN RACE AT THE NORTH POLE."

In the Review for August is an article copied from *The Dial* headed "The Quest for the Primeval Eden," intended as a criticism on Dr. Wm. F. Warren's new book entitled "Paradise Found—The Cradle of the Hu-

man Race at the North Pole." Its writer does so little justice to the work he undertakes to criticise that I may be pardoned for offering some observations of my own upon the subject.

It is quite conceivable that, according to scholarship, one person should see many important things in a learned and thoughtful treatise like Dr. Warren's which another does not. There has been a vast amount of learned ignorance shelved away in our libraries upon the subject of paleontology and kindred sciences which is absolutely detrimental to the advancement of true scholarship. Teachers of the ancient classics are too generally so muddled by the evil genius of misinterpretation that misunderstanding has become chronic with almost the whole tribe. Having been nourished in a barrel, their vision is bounded by what they are able to see through the bung-hole.

Dr. Warren's book will mean to the reader so much and no more than his familiarity with the general facts and truths of paleontology and its kindred sciences have prepared him to understand. Yet it may be an authentic voice upon the subject of which it treats. To be able to pass intelligent judgment upon it, one must be already well furnished with a broad and varied knowledge of the religious ideas of all the great nations of ancient and modern times—their myths, traditions, and folk-lore—so that he may be competent to compare and relate together the thousand facts bearing upon the solution of the question whether there was for the human race one primitive centre of distribution; and if so, where it was located.

Dr. Warren sets out with the now almost universally accepted doctrine "that the earth is a slowly cooling body." He says: "All authorities in this field hold and teach that the time was when the slowly solidifying planet was too hot to support any form of life; and that only at some particular time in the cooling process was there a temperature reached which was adapted to the necessities of living beings On what portion or the earth's surface, now," he asks, "would this temperature be first reached?" The answer is at once obvious—at the poles. "We asked the geologist this question," says the Doctor: "is the hypothesis of a primeval polar Eden admissible?" Looking at the slowly cooling earth he replies; 'Eden conditions have probably, at one time or another, been found everywhere upon the surface of the earth. Paradise may have been anywhere.' Looking at the cosmic environment, however, he adds, —'but while Paradise may have been anywhere, the *first* portions of the earth's surface sufficiently cool to present the conditions of Eden life were assuredly at the poles.'" Science, then, concedes so much in favor of our author's conclusion that the cradle of the human race was at the North Pole." Why at the North Pole rather than the South, he settles

upon another class of facts which are of a more affirmative character.

In Part III. the author gives the testimony of prehistoric climatology, and of paleontological botany, zoology, anthropology, and ethnology, as declared by all the wonderful discoveries in these several departments of investigation, going to show, as affirmed over and over again, on the highest scientific authority, that "till a very recent period, geologically speaking, our earth enjoyed a warm and genial climate up to the very poles themselves; and that all its vegetation was everywhere evergreen, of much the same type as that which now prevails in the modern tropics." Moreover, the best authorities in the science of paleontological botany in Europe and America "have lately reached the conclusion that all the floral types and forms revealed in the oldest fossils of the earth originated in the region of the North Pole, and then spread first over the Northern, and then over the Southern Hemisphere, *proceeding from North to South.*" Just as conclusive is the testimony that animal life has followed the law. To use Dr. Warren's own words: "From all the facts but one conclusion is possible; and that is that like as the Arctic Pole is the mother-region of all plants, so it is the mother-region of all animals,—the region where, in the beginning, God created every beast of the earth after his kind, and cattle after their kind; and this is the conclusion now reached and announced by all comparative zoologists who busy themselves with the problem of the origin and prehistoric distribution of the animal world. But to believe that Prof. Herr's *Miocene Arctic Continent* was the cradle of all faunal forms, and yet deny that it was also the cradle of the human race, is what few philosophical minds are likely long to do."

Dr. Warren's chapters on Ancient Cosmology and Mythical Geography are perhaps the most interesting and remarkable collection of testimonies in favor of his hypothesis of any in his book. He shows that according to the traditions of all the old nations of the world, Japanese, Chinese, East Aryans or Hindus, Iranians or Old Persians. Akkadians (including Assyrians and Babylonians), ancient Egyptians and ancient Greeks—the cradle of the human race, the Eden of mankind, was in the centre of the earth, and that in nearly every ancient literature we encounter the strange expression, "the Navel of the Earth," coupled with the primeval birth-place of man. This centre of outgoing life has also in all the cosmogonies its Atlas's Pillar, or axis of the world. "It is the the umbrella-staff of Burmese cosmology, the churning-stick of India's gods and demons. It is the Trunk of every cosmical Tree. It is the shadowless lance of Alexander; the Tortoise-piercing (earth-piercing) Arrow of the Mongolian Heaven-god; the Spear of Izanagi; the Hacha de Cobra on which the Heavens of the

Miztecs rested. It is the Cord which the ancient Vedic-bard saw stretched from one side of the universe to the other. Is it not the Psalmist's 'Line' of the Heavens which is 'gone out through' the very 'earth,' and on 'to the end of the world?' It is the Irminsul of the Germans, as expressly recognized by Grimm. It is the Tower of Kronos; it is Plato's Spindle of Necessity; it is the Azacol of the North African Sunis; it is the Ladder with the Seven Lamps in the rites of Mithra; it is the Talmudic Pillar which connects the Paradise Celestial and the Paradise Terrestrial."

This Eden of the race had also in all the cosmologies its Mount of the Gods, Mount Atlas, Olympus, Meru, Tien-Chan, Ila, Sineru, Asgard, and the Aztec Culhuacan, all tell the same story; and all refer themselves by their traditions and religious observances, variously expressed, to a "happy and prosperous place," not in their own midst, but in a far-off land of sacred associations, where the "holy house of the gods" is situated,—a land "into the heart whereof man hath not penetrated;" a place underneath the "overshadowing world-tree," and beside the "full waters." "No description," says Dr. Warren, "could more perfectly identify the spot with the Artic Pole of ancient Asiatic mythology. Yet this testimony stands not alone; for in the fragment of another text we are told of a 'dwelling' which 'the gods created for' the first human beings—a dwelling in which they 'became great' and 'increased in numbers,' and the location of which is described in words exactly corresponding to those of Iranian, Indian, Chinese, Eddaic, and Aztec literature; namely, *in the centre of the earth.*"

When, with all these antecedent probabilities before us favoring the Northern origin of nations, we take into account the myths, traditions, and intimations of ancient history which with greater or less distinctness relate all the races of men to a Northern home, far back in the twilight of antiquity, there would seem to to be no escape from the conclusion of our author that the North Polar regions of the earth were the original abode of the ancestors of the human race.

It would be impossible in this monograph to give more than a mere hint—a simple touch or two—bearing upon the importance of Dr. Warren's book to the really earnest and truth seeking student of Ethnology. To understand its true value he must read it himself. It will prove to him a most invaluable key by means of which many mysteries may be unlocked, and the cobwebs of many vague and misleading interpretations of the ancient classics swept away.

THE SONG-NOTES OF THE PERIODICAL CICADA.

There are few more interesting subjects of study than the notes of insects and the different mechanisms by which they are produced. From the day when Aristotle discoursed upon them they have interested every observant entomologist. It is difficult to record them in musical symbols that can be reproduced on musical instruments, some of the more successful and interesting attempts in this direction having been made by Mr. S. H. Scudder. I have studied closely the notes of a number of species and have published some of the observations.*

In the notes of the true stridulators, more particularly, as to the common Tree Cricket and Katydids, I have been impressed with the variation both in the pitch and in the character of the note, dependent on the age of the specimen and the condition of the atmosphere whether as to moisture, density or temperature. Yet with similarity in these conditions the note of the same species will be constant and easily recognizable.

A few remarks upon *Cicada septendecim* will doubtless prove of interest since the species has this year occupied so much attention. I do not find that the notes have been anywhere very carefully described in detail; nor would I pretend to put them to musical scale. Writing seventeen years ago I described the notes in a general way as follows: "The general noise on approaching the infested woods, is a compromise between that of a distant threshing machine and a distant frog pond. That which they make when disturbed mimics a nest of young snakes or young birds under similar circumstances—a sort of scream. They can also produce a chirp somewhat like that of a cricket, and a very loud shrill screech, prolonged for fifteen or twenty seconds, and gradually increasing in force and then decreasing."†

There are three prevalent noises which, in their blending, go to make the general noise as described above. These are,—

First: That ordinarily known as a *Phar-r-r-r-aoh* note. This is the note most often heard during the early maturity of the males and especially from isolated males or from limited numbers. It is variable in pitch and volume according to the condition just mentioned as generally affecting insect melodists. Its duration averages from two to three seconds; and the *aoh* termination is a rather mournful lowering of the general pitch and is also somewhat variable in pitch, distinctness and duration. In a very clear atmosphere and at certain distances an individual note has often recalled that made

*3rd Rep. Ins. Mo. pps. 14, 153, 154: 4th do. p. 139; 6th do. pps. 150—169.
†1st Rep. Ins. Mo. 1868, p. 24.

at a distance by the whistling of a rapid train passing under a short tunnel. But when heard in sufficient proximity, the rolling nature of the note will undoubtedly remind most persons more of the croaking of certain frogs than of anything else. I have heard it so soft and low and so void of the *aoh* termination that it was the counterpart of that made by *Oecanthus Latipennis* Riley, late in Autumn and when shortened from age and debility of the stridulator.

Second: The loudest note and the one which is undoubtedly most identified with the species in the popular mind, is what may be called the "screech." This is the note described by Fitch as "represented by the letters *tsh-e-e-E-E-E-E-E-e-ou*, uttered continuously, and prolonged to a quarter or half a minute in length, loud and piercing in the ear, and its termination gradually lowered till the sound expires." Dr. Fitch errs as to the length of its duration, and I have also erred in the same direction unless indeed there is a still greater range than my subsequent observations would indicate.

Since this was written I have heard on two occasions this note prolonged to twenty seconds, but this is very abnormal, and I have no other evidence than the season (June 20) that it belonged to *C. septendecim*.

It is more probable, however, that our memories were at fault, for, as I have verified this year, this *shrill* ordinarily lasts from two to three seconds—though occasionally longer—and is repeated at intervals of every five seconds. This note is rarely made by solitary males or when but few are gathered together, but it is the prevailing note in the height of the season, and is made in unison, *i. e.*, the assembled males on a given tree, or within a given grove, are prompted to it simultaneously, so that its intensity becomes almost deafening at times. It is of the same nature as that made by the Dog day Cicada (*Cicada pruniosa* Say) and in its higher and louder soundings is not unlike the commoner shrill of that species, though by no means so continuous. It is what in the distance gives the threshing-machine sound; and it has often recalled that which I have heard in a saw-mill when a log is being cut cross-wise by a circular saw.

Third: There is what may be called the intermittent, chirping sound, which consists of a series of fifteen to thirty, but usually about twenty-two sharp notes sometimes double, lasting in the aggregate about five seconds. This sound is so much like that produced by the Barn or Chimney swallow (*Hirrundo erythrogastra*) that a description of one would answer fairly well for both. It resembles also, though clearer and of higher pitch, the note of *Microcentrus retinervis* (Burm) which I have likened to the slow turning of a child's wooden rattle, highly pitched.

The above notes are, so far as I have observed, of higher pitch

though of less volume in the smaller *cassinii* form.

The other notes viz., that made when the insect is disturbed, and a not infrequent short cry that may be likened to that of a chick, are comparatively unimportant; but no one could do justice to the notes of this insect without describing the three peculiar sounds which I have attempted to describe above, and which are commingled in the woods where the species is at all common, though the undulatory screech is by far the most intense and most likely to be remembered.

[The paper concluded with a description of the mechanism by which these various notes are produced, and after referring to the elaborate works on this mechanism, of Reaumur, Rosel, Solier, Landois and others, agrees with the earlier authors in considering the notes stridulatory rather than vocal. Riley finds that Landois, one of the last writers, who reversed the previous conclusions and asserted the notes to be vocal and due to the metathoracic spiracles, was essentially wrong. The noise produced is not made as in the buzzing Diptera as Landois concluded, for, while the air passages act their part in modulating the vibrations, the source of the noise is found to be in the parchment-like and ribbed drums, a portion of which is made to vibrate with great rapidity by the strong V-shaped muscles located in the abdomen, and which have great muscular power so that, even after separation from the insect, when pressed with a point held in the hand, they produce such intense vibration that it may be likened to a galvanic shock.]

A FIRST-PRIZE ESSAY ON DISINFECTANTS.

So common has it become for inferior work to gain prizes that the best talent rarely now competes. Ignorant or dishonest judgment discourages all such laudable efforts. A case in point constitutes the subject of this article. But for the fact that this one is likely to do much harm to the general public, the best course to pursue toward it is silence. Unfortunately, the subject is a serious one, and becomes doubly serious when the facts all appear. The competing essays have been bound in book form, and the volume is being extensively advertised among the Druggists of the United States. A leading light in the Pharmaceutical world was one of the awarding judges. His high position is sufficient endorsement among the men for whom it is intended. The general public rely upon druggists for information upon this subject. They must prepare all disinfectants used throughout the country unless proprietary. If they imbibe false information, the whole nation must suffer. The splendid work

of the committee on disinfectants of the National Board of Health will be almost nullified by this one volume, unless some warning voice is raised by the friends of sanitary science. Facts necessary to a clear appreciation of the subject are conspicuous by their absence from the article. In no place does the author make clear to his readers what disinfectants really are, how they are tested as to value, nor their relative powers. He makes no distinction between deodorizers and disinfectants, nor does he even hint at the all important distinction between spore-destroying and non-spore-destroying agents. He markedly contradicts himself a number of times; not alone because he fails to distinguish between the guesses of twenty years ago and the knowledge of to-day, but because he fails to see what his own words mean. Instead of attacking, he upholds the most vulgar superstitions. All disinfectants have some defects we must know in order to handle them understandingly. He nowhere shows the defects of the agents he recommends. The price of a disinfectant, while of little interest to the few rich, is the first consideration with the many poor. The author does not deign to give any light upon the question. The two essays given subordinate positions possessed the merit of accuracy. This is much more than can be said of his. Very much of value which he neglects, they present, and nothing of the least utility in his, but can be found in far better shape in each of them. The first condition of the award was to be scientific accuracy. In the public announcement of the decision this condition is unblushingly declared excluded. By what right or authority did they do this? If the judges were not scientific experts upon the subject they should have given place to men who were. We have definite knowledge in this branch of Sanitary Science and competent men substantially agree as to what is true and false, established and questionable. The second condition forbade unnecessary technical terms. The first prize essay is the only one using chemical names where there are distinct common ones, and it even introduces such medical terms as "zymotic." The second condition was as much disregarded as the first. On what grounds then were the prizes awarded? The third and last condition was that there should be "clear directions for the preparation and use of the disinfectant recommended." The committee evidently took this to mean that shot-gun formulae, such as belong to the barbarous stage of Sanitary Science was intended. Good disinfectants are few and simple. Their names and exact relative values with many others of their class were given in the papers already mentioned. In describing their properties, full and complete directions were made clear. The first prize paper was filled up with obsolete receipts and ancient notions of a bygone age. Had the prizes been offer-

ed for an essay on Chemistry, and the highest given to a man who ransacked the literature of alchemy for his matter, the blunder would have been precisely the same in kind. Every stipulated condition of the contest has been wofully violated. The following analysis of the leading features of the paper show its utter lack of value as a contribution to the literature of disinfectants.

"Disinfection is defined to be the destruction of the *poisons* of infectious and contagious diseases." (p. 37.) The poisons of such diseases are the ptomaines. Disinfection has nothing to do with these. It aims at destroying the *cause* of such diseases. He begins with a false definition.

"Fire, certain forms of combustion, or oxidation *alone* are capable of completely disinfecting a locality." (p. 37.) All organic solvents, superheated steam and albumen coagulators he has either forgotten or never knew.

"Disinfectants are of two kinds; natural and artificial." (p. 37.) His classification, like his definition is a blunder. All are natural and all artificial as we view them. A true dual classification would be into physical and chemical. Dry and moist heat find no place in his classification.

"By its (ozone's) formation and destruction a vast amount of *materies morbi* may be destroyed." (p. 38.) The destruction of putrescent matter by ozone or anything else deodorizes but does not necessarily disinfect.

"Pure air must be accepted as the most important disinfectant and preventative measure that we have." (p. 38.) Disease germs can be preserved for long periods of time in pure air retaining their virulence. Sufficient dilution renders them obnoxious. Ventilation is better than disinfection on this account. Pure air, as such, is not known to possess any disinfecting power.

"Second only to pure air is pure water." (p. 38.) Bacteria often make their home in pure water. How then can it be called a disinfectant? Otherwise pure water has been known to contain germs enough to cause an epidemic. Its currents can dilute them. The water cannot harm them. As a cleansing agent to wash them away it is invaluable. As a disinfectant to destroy them it is useless.

"I maintain that pure air and pure water are the most important disinfectants." (p. 39.) Competent judges will maintain that he does not know what a disinfectant is.

"The artificial or chemical disinfectants constitute an important division." (p. 39.) Are air, water and ozone not chemical? It would seem not, as he excludes them from this class.

"Bromine and iodine can be employed directly in the sick room. They are exposed in an open vessel at a slightly elevated temperature." (p. 40.) Who ever tries this trick can be employed directly in getting the undertaker to measure the patient for a coffin; for it will surely be need-

ed if even half enough is volatilized to kill a vigorous germ. No volatile disinfectant is of any value unless used strong enough to destroy all life, and must be used in a moist atmosphere. The author by failing to qualify the truths he has stated of such agents, by these necessary facts renders his whole remarks thereon worthless. No one can employ them as he directs, and gain any good results.

"Heat and steam may be considered as a subdivision of their own among the volatile disinfectants." (p. 41.) It is certainly news to the world that heat is material and can be volatilized.

"The volatile oils. These are feeble disinfectants." (p. 42.) Many volatile oils, such as turpentine, occupy a far higher place as disinfectants than nine tenths of the articles he lauds. As aerial disinfectants they are valueless. As deodorants they are pretty good.

"It (mercuric chloride) is almost exclusively used by physicians and surgeons for cleaning their instruments." (p. 42.) In the most serious cases they are willing to destroy their instruments by this treatment. To say that it is almost exclusively used is to state what is not true. Corrosive sublimate destroys every instrument it touches unless speedily and thoroughly cleaned therefrom afterwards.

"It should be used in the proportion of one to one thousand." (p. 42.) It is just as efficient of one tenth this strength, and far less dangerous. Where no farther dilution is needed one in one hundred thousand has been found plenty where rapid destruction is not so important as thorough work.

"A solution of twice as strong as the foregoing can be used for the disinfection of the sputa and other discharges of cholera patients." (p. 42.) The greater the strength the quicker will it coagulate the albumen around nests of germs and thus act as a preserver instead of destroyer. Here again the author's ignorance appears. He did not know that his advice required supplementing to save it from doing positive harm. Such solutions for such purposes must contain, beside the mercuric chloride, some powerful oxidizer like permanganate of potash to eat away the albumen and let it attack the germs. He did not even seem to know that his aqueous solutions of this salt of mercury would change to calomel unless protected by some other chloride. As his lack of knowledge rendered his advice dangerous and worthless when treating of volatile agents so we discover it has a similar effect in dealing with solid ones. All things considered corrosive sublimate, properly handled, is our most efficient disinfectant. In spite of this fact the author gives it no marked prominence over common salt, quicklime and charcoal, articles perfectly valueless for this purpose. Biniodide of mercury, the most powerful disinfectant known, iodide of silver, ni-

trate of silver and osmic acid—all potent germ destroyers—he has not so much as mentioned. The sulphate and acetate of iron, quicklime, gypsum and charcoal, articles possessing not one particle of disinfecting power, he commends in their stead.

"Twenty-four ounces (of table salt) to a gallon of water, or a handful or so to a pail of water, are the best proportions for ordinary use." (p. 43.) And this from a man who insists upon putting two drachms of Mercuric chloride into a gallon of water for excretions and sputa. One grain has more germ destroying virtue than ten times this amount of salt. Yet he insists upon one hundred and twenty grains.

"As to whether this class (Carbolic Acid) deserves our attention at all is a question difficult for decision." (p. 45.) Copperas and table salt receive a paragraph apiece to laud their virtues as disintectants while the whole phenol group must be extinguished with a doubt. Could anything be more refreshingly verdant? Carbolic acid is bad enough surely. Superstition has caused it to be overestimated. We now know its exact power. It stands far ahead of his whole list if we exclude Mercuric Chloride and the hypochlorites. It is perfectly worthless as an aerial disinfectant. He evidently knows nothing of its place as a disinfectant.

"This group includes the antiseptics, alcohol, etc. Among the prominent antiseptics are benzoic acid and benzoates, borates, as aluminium borate, etc., borax, boro-glycerides, formic acid, picric acid, pyrogallic acid, resorcin, salicylic acid, etc." (p. 45.) What does he mean by "antiseptics, alcohol, etc.?" He seems to think that alcohol is not an antiseptic. Did he fail to put these agents in the order of their power because he did not know enough? It looks like it. As with these, so with all others? their arrangement is a perfect chaos. Why class them as antiseptics and give far less efficient agents the dignified title of disinfectants. The fact is, the man was utterly at sea without compass or rudder. He does not appear to know that antiseptics are disinfectants if strong enough to be used to disinfect or destroy infection and disinfectants are antiseptics if used to keep down sepsis.

"It is impossible to undertake to discuss their (benzoic acid, salicylic acid, etc.) relative value here." (p. 45.) Why not? Many of them are far more important than the majority of substances he has discussed. In fact, this is a common failing of his whole paper. It gives undue prominence to substances of the most trashy character passing with contemptuous neglect the very sheet-anchors of all true sanitarians. Chloride of lime, the queen of disinfectants, he passes by with six lines. Copperas receives a paragraph to itself. The last is no better than a magic sign.

"All that is required to *immediately* purify and sweeten a contaminated

air supply, *however originated*, is to dip a cloth in the liquid (an aqueous solution of chloride of lead and salt) and hang it up in an apartment." (p. 43.) Is the man so ignorant that he for a moment can entertain such a belief? Better things would be expected from a boy of eight or any intelligent but illiterate domestic. Readers of this review may doubt the correctness of the quotation, but I assure them it is a verbatim transcription, unmodified by any context. That such arrant superstition should appear in any scientific paper, would be incredible, if our senses did not confirm it. That the paper containing it should be offered in competition for a prize is almost beyond credulity. That that paper should, in the nineteenth century, win a prize is marvelous! That honest, intelligent men could award it the first prize is, to say the least, miraculous! Can it be possible that the judges ever read the essay in the most cursory manner? Do they know that their decision will make them occupy a position the reverse of enviable, when an intelligent public puts its stamp upon their work? The notes of the paper occupy very nearly the same space as the article itself. They are thrown in without regard to value. Sixteen receipts are given, every one of which is of most questionable worth. Not one of them contains a reliable sporicide. To do the work of five cents' worth of chloride of lime, or a fraction of a cents' worth of corrosive sublimate, would take many dollars' worth of the best he has given.

EDITORIAL.

VIVISECTION.

It is a very amusing task to study the idiosyncracies of human nature as exhibited in communications to periodicals and newspapers. But the most astounding expressions of "crank" theories and views appear in the occasional pamphlet and the ubiquitous tract. One of the latter is thus noticed in *The Medical Press and Circular:*

A lady who evidently feels very strongly on the subject of vivisection has recently gone to the expense and trouble of sending from abroad a circular addressed to "her" colleagues and fellow workers "for the benefit of the human race and animal emancipation." She did not confine her kind attention, however, to those, and those alone, or else she has been gravely misinformed as to our sentiments, and it may be to this we are indebted for our copy. This lady makes a startling though possibly not a novel proposition; she proposes the total abolition of vivisection on animals, and would substitute condemned criminals, whom she would solicit as free agents to offer their degraded bodies while still living for the advancement of science as some slight compensation to society for the wrong they have done her. Should they survive the experiments (a point the lady evidently entertains some very serious doubts upon) a free pardon would be their reward.

Anæsthetics would be allowed, but not encouraged. The author of the circular touches upon a vexed question when she advances that animals are at least as worthy of protection as men, because having no souls, their lives are doubly precious to them. This is more novel than her first suggestion, and takes some answering—we will not attempt it here. She harrows unnecessarily the feelings of the scientific students by depicting in glowing colours the disgust that would be felt and shown by the "fair pure girl," to whose hand he has dared to aspire, if only his revolting practices were brought to light. This is her argumentum ad hominem, and is calculated to act seriously as a deterrent to all but determined bachelors.

She holds up to merited opprobrium those operators whose names are published in the "book of infamy," which would seem to be a directory containing their names and addresses, and is anxious under the lex talionis to provide for their future unhappiness. The author, in her anxiety to wipe out what she characterizes as a "hideous blot" on our fair humanity, occasionally oversteps, like many of her fellows in England, the limits of both courtesy and justice. Looking upon suffering as a means of regeneration, she anathematizes those whose profession and pride it is to alleviate it and condemns its professors to unhappiness in this world and acute suffering in the next.

What a picture, this, of the average woman with a mission! It must not be supposed that the crude and ignorant suggestions, the silly vaporings, the comical gravity, of such female Knights of La Mancha, find no Sancho Panzas as listeners. No doubt a cause which appeals so strongly to the lap-dog interest is as well started into a career of glory and success as the famous colony of Borrioboolagha.

Seriously the lady in question is quite as sensible as the great body of anti-vivisectionists who rant and rave over the corpses of dogs and monkeys slain in the interest of anatomical and pathological science. Who can doubt the benefits derived from vivisection when the experiments of Ferrier, Koch, and others are so full of instruction and help to the medical and surgical practitioner? Through the aid of the great mass of facts which vivisection has given to science, the physicians of to-day have achieved their most notable triumphs over disease and death. The operations through which these facts were reached were not performed from cruelty and blood-thirstiness but from a most benevolent and commendable spirit—the desire to meet the enemy of

"gods and men," death, with the best weapons, the greatest skill, the highest knowledge that may be achieved.

The people who raise the cry against vivisection overlook many other outrages performed on their beloved beasts. What right has man, for instance, to keep that noble animal, the horse, in captivity, to urge him to his task with lash and spur, to mutilate him with brand and crop? What right has he to make the bullock his slave, to slaughter him for food, to rob the young calf of his mother's milk? I doubt if one of these reformers would forego his or her juicy sirloin because the animal that furnished it was butchered,—even though well assured by a thousand examples that vegetables alone will sustain life.

As for the suggestion that condemned criminals supply the place now filled by dogs, monkeys and frogs in the dissecting room, *Knowledge* playfully observes:

> In another column will be found a paragraph taken from our contemporary, The Medical Press and Circular, and containing a suggestion which is perfectly charming in its simplicity. It emenates from a lady who is so gravely exercised on the subject of vivisection of the lower animals as to propose that physiological experiments on them should be absolutely and entirely put down by the strong arm of the law, and that condemned criminals (!) should be substituted for them by the experimenter. "One day," says the veracious American legend, "Billy come home holdin' a little mole by the tail wich some boy had cot and give him, and it was alive. Wen my sister see him she said, O, you crewel, crewel boy, thro it in the fire this minit!"

SENSE-ILLUSIONS.

Mr. R. A. Proctor, following the incentive given by Prof. LeConte's recent paper in the *North American Review*, discusses some illusions of the senses in *Knowledge* for July. Mr. Proctor's genius seems well-nigh universal and he seldom puts pen to paper without having something to say worth the saying. In the paper referred to he shows by a series of simple experiments how untrustworthy the senses are under novel or normal conditions. One would think, for instance, that the sense of touch, in those matters wherein it serves as the medium of apprehension, cannot be deceptive; yet if we cross the tips of the first and second digits, and touch objects with them thus crossed, it will be discovered that the sense of touch is not always reliable. Many other like experiments could be suggested. Several of these are used by conjurers, such as the following: Take a silver half dollar and, holding a companion's hand with the palm upward, press the edge of the coin strongly into the middle of his palm for a few seconds; if you then deftly remove the coin unperceived, at the same time closing his hand firmly, it will be difficult to convince him that the coin is not in his grasp. This is a very amusing "trick" and is frequently performed by the conjurer to the astonishment of his audience and the innocent youth victimized. To the same degree is it possible to confuse the sense of heat and cold. If one hand is placed in a basin of hot water and the other in a basin of ice-water, when both are withdrawn and plunged simultaneously into a basin of tepid water the "feelings" of the two hands give the lie to the assertion of sight that they are both in the same basin of water. The hand that was in the ice-water finds the tepid water quite warm while the hand that was in the hot water disputes this and declares it to be quite cold.

But the sense of sight is, perhaps, the most deceptive of them all; notwithstanding popular notions on the subject. Every lawyer knows the impossibility of finding two witnesses of an event who tell the same story. Indeed this fact, the rarity of agreement between independent observers of events, has led to a distrust of witnesses who repeat the same story without variation or disagreement. In a recent magazine there is a picture of three men walking along a pavement. They are receding from us following each other. The one in front appears of gigantic size, the next somewhat smaller and the hindmost quite diminutive. It seems ridiculous to assert that there is no difference in their sizes yet they measure the same. The illusion consists in drawing the surroundings in proper perspective and abandoning perspective in depicting the figures.

Thus it is not a mark of superior wisdom to rely upon the verdicts of the senses indiscriminately. It might be justly suspected that many of the marvels that we are accustomed to hear testified about so volubly are merely "Illusions of the senses."

The subject of a public park for Kansas City will attain as much importance shortly as any other question of municipal progress. Any one who will drive to the ford on Brush creek, south of the city, and turn eastward down a wood-road for a few hundred yards, will reach as pretty a piece of sylvan scenery as may be found anywhere. There is a mimic water-fall, with crystal-clear water and unfailing spring. Rocks abound and quiet pools and shady trees. Below the little cataract is a bayou which could be easily given the aspect of a natural lake. Around are highlands and lowlands giving variety to the landsbape.

If it is not possible to get ground enough for a park on the river-front, (on the bluffs east of the city), at a fair valuation there is no spot around Kansas City more suitable than the one on Brush-creek.

"The Henry Electric Motor, of this city, of which so much was expected, is taking a rest in the torpid state. It was to be in practical operation for the Inter-State Fair, to be held next week, but as is always the case in such failures, the manufacturers of the special car required for the purpose failed to come to time, and now we are to have another interregnum in the date of the opening exhibition. The truth of the matter is that some of the projectors and stockholders are also interested in a new to-be-patented flying machine, and you know the old adage about having too many irons in the fire."

The above clipped from the *Eledtrical Review* is quite amusing as an evidence of the tendency of very wise men to be gulled by a cleverly written hoax. The Henry Electric Motor is not "torpid" and the flying-machine company was the creation of an enterprising and ingenious young man on the staff of a local newspaper. The same reporter has successfully palmed off several new stories of the same sort lately, including one on a perpetual motion machine and one on an air engine which is to pump its own air into the receiver. The Electric Railway Co. referred to has secured the switch of the Ft. S. & G. from the Rosedale road to the Fair Grounds and their new car will shortly be here and a final test made of Mr. Henry's invention.

The eighteenth annual meeting of the

Kansas Academy of Science will be held at Manhattan, Tuesday, Wednesday and Thursday, November 10th, 11th and 12th, 1885. The business meeting will be at 3:30 p. m. of the 10th, at the Agricultural College, where the day sessions of the Academy will be held.

The citizens of Manhattan offer to entertain at their homes those who prefer such entertainment, and reduced rates are secured for those who prefer to accept the accommodations of the hotels. Free carriages will be provided for the transportation of visiting members to and from the trains, and between the Town and College.

Those expecting to present papers are requested to announce their titles to the Secretary, at Manhattan, AT ONCE, in order that they may be properly ararranged in the programme.

The conclusion of "A Chinese Columbus" was crowded out this month but will appear in the November number.

It is to be hoped that patrons of the REVIEW will send in their subscriptions without further delay. We intend that the West shall have a first-class magazine but this intention must meet a more substantial appreciation than fine phrases and flattering testimonials.

The REVIEW intends shortly to commence a thorough and scientific investigation into the sources of water-supply for Kansas City; the facts and conclusions to be applicable to the general sciences of hydrostatics and hydrology as well as to the purpose of the special enquiry.

CORRESPONDENCE.

CHANGE IN THE NEBULA IN ANDROMEDA.

EDITORS KANSAS CITY REVIEW:

The phenomenon now taking place in the Andromeda nebula is being watched at this observatory with interest. It was first detected by Dr. E. Hartwig in Europe, and by W. H. Numsen in Baltimore, about Sept. 1st. It consists of a bright star-like nucleus in the centre of the great nebula, that has very recently developed. We observed this nebula on August 24th, and no trace of a nucleus was seen, but on Sept. 4th it was a conspicuous object. Three theories may be advanced concerning the apparition. It may be a new star that has formed on the farther side of the Nebula, and shines through it, or a new star on this side, or a new sun in process of condensation from the mass of the Nebula itself. The first two hypotheses are most improbable, while the latter is reasonable and seems in accord with what little we know regarding the sideral heavens, and their processes of evolution. If the Nebula is condensing into a sun, it is the most stupendous spectacle ever beheld by human eyes. It has been granted to man to witness creative action, and look upon the formation of a sun. The distance of the nebula is unknown, but in all probability, that ray of light

which now enters our telescopes from this incandescent nucleus, has been on the flight hither for more than one thousand years, with a velocity of 186,000 miles each second. The nebula has a large angular diameter, hence, when we contemplate its distance we cannot fail being impressed with its real and mighty dimensions—hundreds of times greater than the expanse of the Neptunian orbit—and when this bulk of atoms combine and conduse into a liquid sun, the evolution of energy in the form of heat and light, takes place on a most magnificent scale. Yet so distant is the grand illumination that only a few rays reach the earth to be eagerly caught up by a spectroscope in the hands of some student seeking to learn what elements there are in an incandescent state. In 2,000 years from now it will be regarded as the star of 1885.

EDGAR L. LARKIN.

New Windsor, Ill., Sept. 22, '85.

TWO NEW CHEMICAL TERMS.

EDITORS KANSAS CITY REVIEW:

It is the general accepted theory among scientific men now-a-days that almost all matter, whether elementary or compound, exists in the molecular state. Whenever molecules are spoken of, they are commonly characterized as simple or elementary, and compound. Now it seems to me that *two new terms* are needed in chemical nomenclature for expressing clearly and concisely the distinction between molecules of simple substances and of compound substances. Such terms may exist but I have not seen them. The terms I propose to introduce may be in use but I have never met with them. They are formed on the analogy of homogeneous and hetereogeneous, viz: *homatomic* and *heteratomic*. As illustration, I would say the molecules of hydrogen are homatomic, but the molecules of water are heteratomic.

If these terms are unnecessary, or old, I would like to know from some good authority; if new and useful as well would I like to know.

PROF. T. BERRY SMITH,

Pritchett Institute, Glasgow, Mo.

SCIENTIFIC AND INDUSTRIAL NOTES.

FORMATION OF COAL.

The American Cyclopedia admits that there is no generally accepted theory for the formation of mineral coal; and in confirmation, quotes six partially recognized theories and the arguments of their endorsers and advocates. It is in order, therefore, to offer for consideration theory No. 7, which proposes to demonstrate, analogically, to the satisfaction of at least one of your readers, that the great coal beds of Pennsylvania were formed by chemical action of the elements in solution and suspension in the water, and that these elements came direct from the interior of the earth by volcanic action.

The most popular scientists of the day agree upon the theory that "mineral coal is of vegetable origin," requiring millions of years to grow the vegetation, and a constant up and down tilting of the earth's crust, to grow it, and cover it up; and yet they have never agreed fully upon the mode, in detail, by which the series are repeated, time and again, in such uniformity. They ignore the true solution of the question, chemical analyses, and pin their faith

upon the incidental deposits of fossils, as their guide to the age of these several formations. They generally agree, however, that the carboniferous age did not commence until after the deposit of the sedimentary formation, called by Rogers the Seral Conglomerate or Formation No. XII. of the Pennsylvania nomenclature; and that any traces of coal below the seral conglomerate are "abnormal," "sporadic" and "illegitimate."

Now, we do find good coal fields in the lower formation, in series of the same uniformity, and quite as free from impurities as the best seams in the carboniferous formation No. XIII. This is not theory but fact; hence the necessity for a new theory, to give this legitimate coal an honest parentage.

When we consider that all the elements found in the earth's crust originated either in the atmosphere or in the mass which forms the interior of the earth, we must certainly look to the interior magma for the most of the metallic bases of the rocks, including stone coal.

Neither hydrogen nor carbon are very abundant in the atmosphere; but they are abundant in the entire crust, as the volatile portion of the vast beds of coal, as petroleum, and in numerous gaseous forms, as natural gas and the fire damp of coal mines. The recognized series of hydro-carbons are numerous.

The chemists of the latter part of the eighteenth century have left their records of the discovery of the fact that metallic bases immersed in some of the hydro-carbons may be entirely surrounded by oxygen without oxidation, unless brought into atomic contact by agitation; and experiments within the past few months have demonstrated that metallic carbon may be heated in atomic contact with any oxygen, without combining, until moisture is introduced in some form.

The best authorities in chemistry recognize both hydrogen and carbon as metals; therefore, inorganic. Now, grant that these elements, in the form of hydro-carbons, have their origin in the interior magma; then by oxidation of the metallic bases we produce combustion and decomposition of the hydro-carbons, setting free the hydrogen to mingle with the oxygen of the atmosphere to form rain, while the carbon and oxygen will form carbonic acid, to be brought down from the atmosphere by the rain into the water on the face of the earth. Whenever the crust of the earth becomes thich enough to obstruct the free passage of these gases and other products of oxidation, combustion, condensation, and decomposition, paroxysmal and volcanic action will result, and the igneous mass resulting from said oxidation and combustion will be outpoured upon the surface to thicken the earth's crust. If poured out in the atmosphere to cool slowly, to form crystalline rocks; if injected from below into the water basins, to become disintegrated, the coarser portions to come down as conglomerate rock, while the finer parts will dissolve in the acidulated water or be held in suspension in the water as mud, to come down as chemical compounds, precipitates, and mud slates and shales.—Titus E. Emery in Coal Trade Journal.

ANCIENT METHOD OF WASHING GOLD.

The gypsies of the Banat in Austro-Hungary, in washing the gold from the sands of the rivers and plains, still use a very antiquated system, out of which no doubt the modern systems have grown. It is practiced now by the gypsies as it was by the Romans in the same country. It consists in nothing more than pouring the sand, mixed with water, over an inclined plane, the heavier particles of the gold remaining upon the surface, while the light impurities are washed away. Sometimes the inclined plane is covered with woolen cloth, to which the gold adheres; wanting the cloth, the gypsies now and then use for the same purpose the more ancient substitute of a fleece. The manner of collecting gold dust on sheep's fleeces upon inclined plains is represented in the curious old works of Agricola. In the rivers of Colchis, the custom is still retained of placing sheep skins in the beds of

the Phasa and other auriferous streams to collect particles of gold, hence the dedication of such fleeces to the gods, and the fabulous history of the Argonauts, as far as it related to the Golden Fleece. The more common manipulation among the gypsies of the Banat, as far as the gold washing is concerned, is performed by means of a plank of a lime tree, six feet long and one and a half inches thick. At the upper extremity is a small trough, and across the board are about a dozen grooves or furrows cut in the wood. The plank is set at an angle of 45 degrees. The sand is put into the trough at the upper end, and thence, by plenty of water washed down the sloping board. The gold dust falls into the grooves, whence it is scraped or brushed off. It might be supposed that a great deal of gold is lost by the careless method, but long experience has made the gypsies very expert; they know how to distinguish the rich and poor sand, and a careful examination of the tailings proves that hardly a particle of gold escapes them during the operation. The gold is in the form of a fine dust, the sand containing it is mixed with black particles of highly magnetic iron, garnets and mica. —London Mining Journal.

THE CREEPING OF RAILS ON THE ST. LOUIS BRIDGE.

The rails forming the double line of railway over the St. Louis bridge move in the direction of the traffic at the rate of more than a foot a day. This creeping occurs only on the bridge proper (1600 feet in length and rising five feet from each abutment to the center), and on the eastern approach (2500 feet long, gradient 1 in 66, and consisting of short girders on iron columns). Various methods have been tried to keep the rails in place, but without success, and the practice is now to leave the rails to creep, cutting out and filling in as may be required at the butments and at the foot of the east approach. This has to be done many times a day at each place. In the twelve months ending August 1884, the rails of the north line traveled 400 and 401 feet respectively up the approach, and 268 and 260 feet respectively over the bridge, while the rails of the south line traveled 414 and 415 feet respectively down the approach, and 240 and 239 feet respectively over the bridge. The ratio of westward to eastward movement on the bridge is 1,099, and this is exactly the ratio of westward to eastward tonnage. On the approach this proportion does not hold, the result being affected by the heavy gradient. An analogous phenomenon is the creeping of bridges on their supports. If a bridge have its two ends similarly mounted, when a train comes upon it from the right this end is at once pinned fast by the weight of the train. The deflection caused by the train lengthens the bottom chord and shortens the top chord of the truss, so that if it is supported at the bottom chord, the left end moves to the left, and if at the top chord, the left end moves to the right. As the train passes off at the left end, this end of the truss is pinned fast while it recovers its shape, and consequently if the truss is supported at the bottom chord it will have moved bodily to the left, and if at the top chord to the right.

The author considers the various explanations already offered to account for the creeping of the rails, showing them to be either insufficient or unsatisfactory. His own explantion, the result of accurate observation, and supported by interesting experiments described in the paper, is that there is a wave-motion of the rail independent of its supports, such a wave occuring under each car and moving with it, giving a slight forward motion to the rail everytime a given section is brought down upon the support. The total movement for one train will thus vary with the number and weight of the cars. On the bridge, the rails (flat-bottomed) rest on pillow-blocks of gunwood $5\frac{1}{2}$ inches thick, held in position between longitudinal channel-irons. These blocks are 17 inches long and spaced 19 inches apart end to end. The wave-motion of the rail is due to the elasticity of these supports. The rail is held fast on the supports by the load, on its extended side. This causes it to measure its length across

the bridge on its extended side, or it may be said to roll itself across the bridge on its extended side. If, instead of being supported at the bottom flange, the rail were supported at a point above the neutral axis, there will be a tendency for it to creep backward, that is, against the direction of the traffic, owing to the compression of the upper side. There would, however, also be a tendency for it to move foward, as the neutral axis when thrown into waves is longer than when at rest. Again, if the rail were supported from the upper surface, the creeping would be backward. There is, therefore, between the neutral axis and the upper surface of the rail, a line along which, if the rail were supported, there would be no tendency to creep either forward or backward.—[T. B. Johnson in Journal of the Association of Engineering Societies.

WHERE TORNADOES MOST ABOUND.

Sergeant Finley's elaborate and valuable report on the tornadoes of 1884, recently issued by the Signal Service Bureau, illustrates with charts the fact that these startling and destructive phenomena, like most hail and thunder storms, occur in places lying southeastward of a large barometric depression or "low center." The observations which form the basis of this report, says the New York Tribune, confirm various previously accepted theories regarding tornadoes, such as their occurence mainly in the afternoon, their generation by the conflicting polar and equatorial air currents, and the development of considerable electricity in connection with them. But the discovery just mentioned is of more practical service than any of the other facts brought out in indicating the possible outbreak of tornadoes in a given region. Inasmuch as these storms occur anywhere from 200 to 800 miles from the low center, a large area may be imperiled at one time, and the suddenness of formation, the narrowness of track and the brevity of the period of havoc make it impossible to foretell precisely in what localities within this broad region the outbreaks will occur; nor can any one say definitely how plentiful a brood of destroyers will be hatched, though the conditions favorable to their birth are distinctly recognized. Yet the importance of even the slightest valid warning will be appreciated when it is known that in a single tornado season of a few months over 1000 lives may be lost, 2500 persons injured, and property valued at over $13,000,000 destroyed. Such at least was the case last year; the destruction wrought in one day, September 9, being estimated at $4,000,000.

Sergeant Finley's tables show that the south suffered to an exceptional degree from this cause in 1884. Georgia, Alabama, and the two Carolinas were visited by one-half of the 180 tornadoes reported from the whole country. That particular district is more liable to such visitations than many other parts of the Union, but not so much so, on an average, as another tract embracing most of Kansas and portions of Missouri, Nebraska, Minnesota, Iowa, Illinois and Indiana, which, together, experienced only thirty-five last year. A schedule once prepared by Sergeant Finley, who has long been studying this subject, showed the distribution of tornadoes for the five years ending with 1880. This gave the four States first named 8.5 per cent. of the whole number, and 28.7 per cent. to the other seven. Another tabulation made by the signal service, including about 600 tornadoes, and covering eighty-seven years, still further established the fact that the northwestern tract already described is the chief sufferer from these afflictions; and the eastern cotton States come second. Texas is the region of next greatest frequency.

No theory is contained in Sergeant Finley's report to explain this exceptional prevalence of tornadoes in the south last year. An analysis of the returns, however, shows that a large proportion of last year's crop was produced in the spring season, while yet the low centers, which at intervals of several days are forever crossing the country in an easterly or northwesterly direction, were taking a somewhat more southerly course than in the summer months—usually the period of greatest frequency.

Thus, more tornadoes occurred in February last year than in July; although they were confined to two days in the former month, and distributed among fifteen in the latter. The tornado season this year did not fairly open until May; the greatest abundance was produced in June and July, when the low centers, mostly born in the middle plateau of the Rocky Mountains, were traveling along or north of the line of the great lakes; and a great majority of the attendant tornadoes have been experienced in the northwestern area already indicated as most liable to be thus visited. Still, without extending one's observation beyond these two years, it would be hasty to assume that the distribution of tornadoes any year depends upon the time at which the season opens.—Jour. of Com.

THE LONGEST BRIDGES IN THE WORLD.

The Moniteur Industrial gives the following as a list of the twenty-six largest bridges in world:

	Feet.
Montreal bridge, over the St. Lawrence	8789
Brooklyn, over the East river	5989
Rapperswyl, Lake Zurich	5333
Volga, over the Sysran, Russia	4947
Moerdyk. Holland	4927
Dneiper, near Jekaterinoslaw, Russia	4213
Kiew, over the Dneiper	3607
Barrage bridge, Delta of the Nile	3353
"Kronprinz Rudolph," over the Danube, at Vienna	3266
Dneiper, near Krementchough, Russia	3250
Bommel, over the Meuse, Holland	3060
Two Bridges of Rotterdam, over the Meuse.	2833
Mississippi bridge	2588
St. Louis, over the Mississippi	2574
Saint Esprit, over the Rhone, France	2460
Kinlinbourg, over the Rhine, Holland	2347
Cincinnati, over the Ohio	2333
Chaumont Viaduct, Valley of the Suize, France	2000
Menai, England	1957
Cubzac, over the Dordogne	1817
Varsovie, over the Vistula	1693
Iron bridge, at Bordeaux, over the Garonne	1667
Stone bridge, at Bordeaux, over the Garonne	1623
Beaucaire, over the Rhone	1460
Tours, over the Loire	1457
Alexandre, at St. Petersburg	1350

Of the above the sixth on the list has recently been opened, the Rapperswyl bridge is merely a pile structure and is only thirteen feet wide; the Sysran bridge over the Volga carries the Orenbourg railway, and was only finished in 1880; it has thirteen spans, and is raised 130 feet above the level of the river; it cost 13,500,000 francs.

The Moerdyk bridge carries the Anvers and Rotterdam railways over the Meuse, which is about 8,800 feet wide at this point, and has been reduced by dykes; it has fourteen spans of 328 feet each. It was commenced in 1868 and finished in 1871; it cost about 12,000,000 francs.

The above list is given as printed, but the compiler in the Moniteur has in his table wholly ignored many long American bridges. A complete list of the length of modern iron bridges is not just now accessible, but among the omissions may be noted:

	Feet.
B. & O. bridge, at Havre de Grace	6000
Wooden bridge at Columbia, Pa	5366
Louisville railroad bridge, over the Ohio	5218
Cincinnati Southern railroad bridge, over the Ohio	3950
Havre de Grace bridge, over the Susquehanna	3271
Dauphin bridge, over the Susquehanna	3590
Monongahela bridge, near Homestead	3000
Plattsmouth bridge, over the Missouri	3000
Quincy bridge, over Mississippi	2857
Omaha bridge, over Missouri	2750
Keokuk, Ia., bridge, over Mississippi	2008
La Crosse bridge, over Mississippi	1672
Boonville bridge, over Missouri	1651

To the above many other long bridges could doubtless be added, were the data at hand. The longest bridge in the world was the late Tay bridge which was 10,320 feet in length, and the Forth bridge now under construction is to be about 9,200 feet long. Although it does not strictly belong to the class in question, the New York elevated railway is a continuous iron truss bridge, and the aggregate length is thirty miles—Journal of Commerce.

EDIBLE EARTH.

Clay is composed of silica, alumina and water, colored by metallic oxides. Some samples of edible earth are composed as tripoli is, of innumerable microscopic and fossilized shells of fresh-water infusoria. How men came to have recourse to such aliment may be without evidence; but similar circumstances have led to like results in countries remote from each other. The Otomacs, a people of Southern America, take regularly a pound or more per day of a rich clay which appeases hunger without injury. Among the Indians on the border of the Amazon clay forms a part of their food, even when other aliments abound.

Edible earth is found in Bolivia, and one kind, which has an agreeable odor, is much esteemed by the Peruvians. The negroes of Jamaica have recourse to it when other food fails; on the other hand, the negroes of Guinea, transported to America, seek for an earth like what they are accustomed to, and in its absence they consume the white pie-clay, to the injury of their health. In the kingdom of Siam the women and children are earth-eaters; in Java (says Labillardiere) they make a sort of cake of ferruginous clay, which is eaten to produce leanness. It is an object of commerce in Anam and Tonquin. The usage is widespread, existing in Guina, New Caledonia, Siberia, Terra del Fuego, and some descendants of the old navigators in Portugal. The Indians of the Dutch colonies of Java and Sumatra make a peculiar preparation with edible earth, reducing it to a paste with water, spreading it into thin plates, morsels of which are grilled in a pan over a charcoal fire. These little slips, rolled up, are like dried barks of a warm gray or ruddy color. They also make roughly moulded figures like our gingerbread men and sweetmeats. M. Hekmeyer showed at Amsterdam, in 1883, specimens of edible earth in its natural state and prepared also a few little figures, imitations of fruits and fancy objects. The flavor of these delicacies is empyreumatic, and the mild, slightly aromatic sensation which follows the first taste arises from the earth itself, to which no condiment is added. The early origin of the custom of making various alimentary substances into human shapes is obscure--[Science Monthly.

A BLACK INVENTOR.

A recent issue of the Montgomery (Va.) Messenger contains the following:

Minnis Haden, a worthy colored blacksmith of this place, has lately invented one of the most ingenious and valuable devices we have ever seen. Being a poor man and unable to employ a hand as striker, he cast about how he might do by machinery what heretofore could be done only by the hand of man. The result of his cogitations is a piece of very simple machinery by which the striking hammer is easily and effectively worked by his foot, while he has both hands free to hold his iron and use the small hammer. To a listener the blows come as naturally and as rapidly as if there were two men handling the hammers in the old-fashioned way, but there is a difference. The machine, by an easy motion of the foot on the treadle, strikes a harder blow than any man can strike, and can be made at will to strike as light a blow as may be needed. But the use of this simple and cheap device in the blacksmith's shop is not half. It can be just as easily used, and will find a large field of usefulness, in driving a drill for blasting rock. In its present form, without any change, one man can drive a drill perpendicularly as easily as three men now do the same work. By a very simple and easy plan hammers can be provided and attached, which will make it just as easy to drive a hole horizontally or at any required angle, and the whole work can be done by one man. The machine is portable and need not be very heavy. Mr. D. W. Frizzell has become a part owner of this invention. A caveat has been secured, and Mr. Frizzell is expecting to receive a patent as soon as the papers are made out.

A MARVELOUS GOLD FIND IN MICHIGAN.

The recent gold discovery near Ishpeming, Mich., proves to be of marvelous richness--a veritable bonanza, vouched for by that reliable authority, the Marquette Mining Journal, the editor of which visited the "find" and publishes a detailed account thereof in the last issue. The vein is located on section 35, township 48, range 28, and has been explored about 800 feet. The first discovery was made June 14th, by W. L. Jones, an assayer of Ishpeming, but being on land owned by the Lake Superior Iron Company was kept quiet until terms could be made with the owners, failing in which the vein was traced to land adjacent, which has been leased by Mr. Jones and his friend. The richness of the vein was unknown until the second week of this

month, when a single blast in a pit 6 feet in depth revealed a width of 4 feet of "sugar quartz," carrying free gold and assaying $20,000 per ton. The quartz is very brittle, crumbling easily under the pressure of the fingers. The Mining Journal's account says: "The rock is of wonderful richness, and it was the writer's privilege to secure from the vein, with the aid of a hammer and drill, a number of pieces carrying free gold. The quartz is well mineralized, and, unlike other gold bearing rock, carries very little silver, the gold being nearly pure The average value of the quartz cannot be accurately stated, but many specimens which have been taken from the opening described, would give an average of from $20,000 to $40,000, and even more, per ton; but this cannot be called the average value of the rock. That it will go up in the thousands is, from indications, beyond a reasonable doubt. With such a surface showing, the property may yet become more valuable even than is now thought by the most sanguine. It is certainly the richest thing yet found in the upper peninsula. The Nelson House 'lay out' of new specimens from the new find was duly examined and admired. It is, indeed, a magnificent showing of richly mineralized quartz, many of the pieces being thickly studded with virgin gold, which appears all through them in a variety of beautiful forms. Much has been said and written to prove that this region contains rich deposits of gold, but the best argument in support of this proposition—an unanswerable one, in truth—is to be found in this group of beautiful specimens, all of which were taken from a sinking in the vein less than six feet from the surface."

It is hardly necessary to add that the people of the upper peninsula are greatly excited over the discovery, and the prospecting now going on will likely develop other rich deposits.—The Age of Steel.

KENDALL'S ELECTRIC GENERATOR —A COAL BATTERY.

A report in the Engineer, states that at the International Inventions Exhibition, Mr. J. A. Kendall, of North Ormsby, Middlesborough, exhibits an electric battery, which appears to be a decided step in the direction of producing electricity from the oxidation of coal without the intervention of a steam-engine. The battery is based upon the well-known phenomenon of hydrogen passing through platinum at a red heat, two platinum plates being used as the poles, one exposed to hydrogen and the other to oxygen. These plates are arranged in the form of concentric tubes closed at one end, and are separated by a fluid medium of fused glass. Hydrogen gas is continuously supplied to the inner platinum tube, while the entire apparatus is maintained at a high temperature by means of a furnace fed with coke or liquid or gaseous fuel. The absorption of hydrogen by the platinum is accompanied by electric generation, and the current is led away by wires connected with the platinum tubes. It is curious, however, that, so long as the two platinum tubes are not connected by a metalic circuit, the passage of the hydrogen is slow, but that, as soon as the electric circuit is completed, the rate of flow is suddenly increased and is steadily maintained at the higher amount. In the case of a group of cells or battery, the same gas-furnace may be used to heat the series. The cells are connected for quantity and intensity as in the voltaic battery. The electro-motive force of a cell is given by Mr. Kendall, as about 0-7 volt. This is of course, much less than the theoretical electro-motive force of a hydrogen and oxygen couple, and the remaining energy evolved by the combination appears to be developed in the form of heat at the surface of the oxygen plate, and serves to keep up the temperature of the apparatus. In the action of the battery, the hydrogen in passing through the inner tube is, so to speak, filtered off from any gases with which it may be mixed. The residual combustible gases, if any, when drawn off by the escape jet, can be utilized as fuel for the furnace. This is a very valuable feature, as it enables the battery to be worked with Strong-producer gas, consisting mainly of hydrogen and carbonic oxide, and to be arranged in a very com-

pact way, the spare heat left from heating the cells being available for working the producer. Mr. Kendall proposes to employ it for a variety of purposes—for example, the driving of electric launches, and so on. With the new generator, all that is required to maintain the working is a supply of fuel and a little water. The inventor estimates that a ton of coke used in heating the battery, including the hydrogen producer, will give at least three times the electrical energy that would be produced by the same quantity of coke used in working a steam-engine and dynamo. It is also hoped by the inventor to develop the new process of electric generation for lighting purposes. Houses can in this way be lighted by incandescent lamps by means of coal-gas supplied to the premises; and larger centers illumination could be economically worked by the use of ordinary fuel, such as coal and coke.

THE NEW STAR IN ANDROMEDA.

The importance of the latest news gathered from the starry heavens has, apparently, been hardly comprehended, even by many of the astronomers themselves, remarks the New York Sun. To say that a new star has appeared among the countless brilliant specks of light that enliven the sky at night does not seem very startling, especially when the new star is so faint as to escape all eyes except those that are aided by the telescope. The news assumes greater interest, however, when it is considered that this new star is a sun, as large, probably, as our own sun, which has suddenly sprung into being in the depths of space, lighting up with its radiance a corner of the universe hitherto buried in the gloom of perpetual night.

But the most interesting fact about the new star in Andromeda is that it appears in the centre of a nebula, thus giving some countenance to the assertion which has been made that it is a marvelous example of the process of nebular evolution by which our own solar system is believed to have been produced. If this is so, however, we have here an instance in which the exceeding slowness of development assumed in the Hebular Hypothesis is replaced by a sudden bound from the nebulous to the solar condition. It appears that early in August certain observers saw a singularly bright spot in the Andromeda nebula which, however, was clearly a nebulous mass and not a star. In a month a star glittered in the place of the curdling fire-mist! Thus, if we believe that the new star really belongs to the Nebula of Andromeda, men have beheld the birth of a sun, not by gradual processes of contraction covering ages upon ages of time, but by a sudden spring into being, a burst of splendor in which the dull and scattered matter of a dimly glowing nebula has, almost in a twinkling, been transformed into a magnificently blazing sun, pouring the sudden light of day into the depths of space for millions of miles around it.

We can behold no spectacle on earth comparable with that. But a great deal of evidence will be required to convince astronomers that this is the actual history of what has occurred. They will probably sooner believe that the new star is the result of some collision of dark bodies in space, or of a terrific outburst of fiery forces in such a body lying between us and the Andromeda nebula, rather than that the step from nebula to sun could be so suddenly performed.

It is as yet all a great mystery, and the solution of it, whatever it may be, cannot fail to prove intensely interesting.

LABOR AND CAPITAL.

At the recent meeting of the American Institute of Mining Engineers in Halifax, President J. C. Bayles delivered a notable address on "The Existing Relations of Labor and Capital in the United States." Among other things Mr. Bayles said: "If the great problem of the improvement of the condition of the working classes is ever to be solved, we whose minds are trained to logical and purposeful thought, and who control the machinery of capital, must at least help solve it. For the idle and vicious there is nothing but the bitter fruits of idle-

ness and vice. Those who break the inflexible laws of nature must expect to incur her inexorable penalties, and it would be a false and hurtful philanthrophy which should seek to avert them. But for industry and thrift there should be something better than our present industrial system gives. Arbitration should decide fairly and impartially the issues between workmen and employer, and some part of the profits of production should seek investment in ways which will react favorably upon the interests of labor. Participation should be established on an equal basis as the reward of faithful service, and co-operation should be promoted wherever and whenever it can benefit the wage earners. What may be our duty in these directions depends upon what may be our opportunity. There is, I fear, much of truth in the assumptions of the International Workingmen's Association that the laboring classes have nothing to hope for from the higher classes, but must fight out their own emancipation. If left to themselves they will undoubtedly fight to attain it; if intelligently aided and led they will work it out by peaceful and beneficent means. Such leadership and direction will come, if at all, from the men of education who are carrying on for capitalists or corporations the productive industries of the country. Each of us can contribute something to the solution of the great problem, and each may succeed in proportion to his opportunities in reducing the barrier which has been built up between the classes into which society is divided."

TELEGRAPHING TO AND FROM MOVING RAILWAY TRAINS.

The following details, from a late lecture on "Induction" by Mr. Frank Kitton, will serve to give a fair idea of the operation of the Phelps system of telegraphing to and from moving railway trains, which is now attracting attention.

In the first place, an insulated copper wire, suitably inclosed, is run along the railroad track midway between the rails. This may be called the secondary wire. Underneath the car, fitted with the necessary instruments, is placed an iron pipe (running the whole length of the car), in which is placed the primary wire, which passes first through the pipe, is then brought up into the car and strung along the top, after which it descends through the car into the pipe again, and so on, until the latter contains about ninety convolutions of wire, the ends or which are made to terminate in suitable telegraph apparatus. Every time, therefore, the telegraph operator in the car manipulates his key, he causes a strong current to flow in the wires contained in the pipe, which is placed at a distance of about 7 inches from, and parallel to the wire on the track. An induced current traverses the wire, which is led into the different offices, and is there connected with a similar set of apparatus. This apparatus receives the induced electric impulses and renders them intelligible to the receiving operator. The reverse of this is also true. When a dispatch is forwarded from any of the offices to the train, the currents traversing the wire between the rails are inductively taken up by the parallel wires under the moving car, and conveyed to the receiving instrument, to be there translated by the receiving operator.—Cin. Artizan.

THE AGE OF THE MOUNDS.

Dr. Cyrus Thomas, who is in charge of the division on mound exploration of the Bureau of Ethnology, has in the last three years obtained about 15,000 specimens of the handiwork of the mound builders, the study of which, with the survey of the mounds themselves and their surroundings, is gradually leading to a solution of certain archæologic riddles which a few years ago seemed unsolvable.

While some of the mounds are doubtless very ancient, others similar in character and equally interesting have certainly been built up since the advent of Europeans. A string of sleigh bells much corroded but still capable of tinkling, was found among the flint and bone implements in a mound in Tennessee, while in Mississippi, at the point where De Soto is supposed to have tarried, a Spanish coat of arms in silver, one blade

of a pair of scissors and other articles of European manufacture were found in positions which indicated that they were buried by the original builders of the mounds.

In a Georgia mound two copper plates were found, upon which were stamped figures resembling the sculptures upon the Central American ruins The workmanship is vastly superior to that displayed upon the articles of pottery, stone and bone found in the mounds, and their origin and purpose are not yet explainable. Aside from these plates nothing has been found to indicate a connection between the mound builders and the Aztecs or the Pueblos, while on the other hand, there are many reasons for not going beyond the Cherokees and their fellow red men of the Ohio and Mississippi valley to find the origin of these curious erections.

The purpose of the mounds still remains in some cases a mystery, but in others they are known to have been made sometimes for burial places, and sometimes as foundations for Indian villages, secure from the floods to which the low lands were periodically subjected.—[Norristown Herald.

VIVISECTION OF DOGS.

A large number of dogs have lately been, and are still being cut up by some of the professors of surgery in Bellevue Hospital, New York, in a series of trials intended to demonstrate the feasibility of certain operations upon human beings. Nearly all of the persons shot or stabbed in New York are taken to Bellevue. In cases wherein the abdomen is perforated death usually results from peritonitis, or inflammation of the membrane which lines the abdominal cavity. In various diseases, too, peritonitis is the fatal climax. Surgeon T. Herring Burchard, chief operator in the emergency ward of this hospital, and lecturer in the clinics of Bellevue Medical College, has held a theory thas the mortality from this cause is needlessly high, and that many lives might be saved by the bold surgery of cutting open the body, removing the irritant matter, or even excising gangrenous portions of the bowels, and then trusting to antiseptic treatment for a recovery. He urged that whenever the dreaded inflammation became established to an extent rendering death nearly certain if nothing were done, then the knife ought always to be plied. This was a new and rather startling view even in these days of bold surgery. It was decided to experiment extensively with dogs. These could be obtained in any desired numbers from the public pound. The work was begun last spring, and has proceeded steadily ever since. Over 100 dogs have already been used by Dr. Herring and others interested in the subject. They have suffered the laying open of their abdomens and the removal of sections of intestine to see if they would recover. In a fair number of instances they have done so. The practice is defended on the ground that, could the operation be found practicable in human beings, a great number of lives would be saved by it. Especially would that be true in wars.

METEOROLOGY OF SEPTEMBER.

Prof. Snow, of Lawrence University, furnishes his monthly weather report for September, from which the following is excerpted:

The entire absence of frost, which characterized this month, is not an exceptional feature for September in Kansas. Nine of the eighteen Septembers of our record have been equally favored. The average date of the first autumn "hoar frost" is October 1st, and of the first "killing" frost October 20th. The mean temperature of the month just closed was below the average. The rainfall was almost double the average, and nearly the whole of it occurred during the first week. The wind-velocity was twenty per cent. below the average, and the cloudiness was nearly normal.

Mean Temperature—65.43 degrees, which is 0.99 deg. below the September mean. The highest temperature was 86 deg., on the 24; the lowest was 49 deg., on the 2d, giving a range of 39 deg. Mean temperature at 7 a. m., 59.43 deg.; at 2 p. m., 74.28 deg.; at 9 p. m., 64.00 deg.

Rainfall—5.41 inches, which is 1.97 inches above the September mean. Rain fell on 8 days. There were 4 thunder showers. The entire rainfall for the 9 months of 1885 now completed has been 30.95 inches, which is 2.26 inches above the average for

the same months in the preceding 17 years.

MEAN CLOUDINESS—41 per cent. of the sky, the month being 0.31 per cent. cloudier than usual. Number of clear days (less than one-third cloudy) 18; half-clear (from one to two-thirds cloudy) 2; cloudy (more than two-thirds) 10. There were nine entirely clear days and four entirely cloudy. Mean cloudiness at 7 a. m., 43.34 per cent.; at 2 p. m., 41.67 per cent.; at 9 p. m., 38 per cent.

WIND—S.E., 30 times; S. W., 24 times; N. E., 16 times; N., 8 times; S., 5 times; N. W., 4 times; E., twice; W., once. The total run of the wind was 8,611 miles, which is 2,140 miles below the the September mean. This gives a mean daily velocity of 287 miles and a mean hour velocity of 11.96 miles. The highest velocity was 43 miles an hour, on the 12 th, from 3 to 4 p. m.

BAROMETER—Mean for the month, 29.084 inches; at 7 a. m., 29,100 inches; at 2 p .m., 29.074 inches; at 9 p. m., 29.079 inches; maximum, 29.375 inches, on the 18th minimum, 28.731 inches, on the 7th; monthly range. 0.644 inch.

RELATIVE HUMIDITY—Mean for the month, 73.8; at 7 a. m., 85.5; at 2 p. m., 53.7; at 9 p. m., 81.8; greatest, 100, on the 6th and 7th; least, 8, on the 26. There were two fogs.

A valuable table showing the meteorological history of this month for seventeen years is added.

ASTRONOMICAL NEWS.

ASTEROID PALISA (250).

On September 4 a cable message was received at Harvard College Observatory, from Dr. Krueger, at Kiel, announcing the discovery of an asteroid by Dr. Palisa.

September 3.4120 Gr. M. T. R. A. 23h. 34m. 39.9s. Decl. —16° 9m. 35s.

Motion in R. A. —48s., Decl. S. 4m. 11th magnitude.

ELEMENTS AND EPHEMERIS OF COMET BROOKS, 1885.

The position of the comet, published in Circular No. 59, as secured at Harvard College Observatory on September 2, was, as stated, merely approximate. An accurate reduction of the observations is given below, together with Harvard positions on September 3 and 6.

September 2d, 13h. 53m. 6s. Gr. M. T. R. A. 13h. 42m. 28.24s. Decl. +36° 38m. 2.5s. Observer, Pickering.

September 3d, 13h. 10m. 59s. Gr. M. T. R. A. 13h. 47m. 43. 39s. Decl. +37° 6m. 13.8s. Observer, Wendell.

September 6th, 13h. 25m. 25s. Gr. M. T. R. A. 14h. 4m. 3617s. Decl. +38° 28m. 33.5s. Observer, Wendell.

From these positions the following orbit has been computed by Messrs. Chandler and Wendell:

ELEMENTS.

Time Perihelion Passage = August 17.75 Gr. M. T.

	°	m.	
Longitude Perihelion	=265	33	} Mean Eq. 1885.0
Longitude Node	=200	34	
Inclination	= 54	05	
Perihelion Distance	=.7544		

It was not intended at first to publish this orbit, it being a rough approximation, and the data somewhat limited but the weather being generally cloudy, with no immediate prospect of further observation, it has been deemed best to make use of it for a finding ephemeris.

EPHEMERIS.

Gr. Midnight.	h.	m.	s.	°	m	Log. r.	Log.	Light.
Sept.	7	14	10 14	−38	53.4	9.9329	9.9546	1.02
	11	14	35 58		40	29.3 9.9521	9.9329	1.04
	15	15	5 9		41	47.4 9.9723	9.9116	1.04
	19	15	37 57	−42	38.4	9.9931	9.8918	1.04

Light on September 2 taken as unity.

CAN UNDERGROUND HEAT BE UTILIZED?

In an article by J. Starkie Gardiner, in the Geological Magazine for September, the above subject is presented with much novelty and interest. After describing the phenomena which prove that the earth's periphery is only a crust of solid matter floating on a molten mass, he asserts that this crust is more likely to be ten than fifty miles thick. He refers to the artesian well now being bored at Pesch, which has reached a depth of 951 meters, and states that the temperature of its water is now 161 degrees Fah., and that the boring will continue till a temperature of 178 degrees is reached. The obvious deduction is that the heat of the earth will ultimately be utilized by man in the place of costly fuel and furnaces. "It needs no seer," he says, "to pierce the not distant future, when we shall be driven to every expedient to discover modes of obtaining heat without the combustion of fuel,

and the, perhaps, far remote future when we shall bore shafts down to the liquid layer and conduct our smelting operations at the pit's mouth."

INFLUENCE OF FORESTS.

Prof. Muttrich, of Berlin, has reached the following conclusion from his forest meteorological researches: 1. That the forest exercises a positive influence on the temperature of the air; 2, that the daily variations of temperature are lessened by the forest, and in summer more than in winter; 3, that the influence of the leafy forest is in summer greater than that of the pine forest, while in winter the tempering influence of the pine forest preponderates over that of the defoliated forest. An attempt to determine the influence of the forest on the mean annual temperature led to no sure results.

The correspondent of the London Times, in Rome, writing from that city recently, says: "An interesting discovery illustrating the commerce and the luxury of ancient Rome has been made close to Monte Testaccio and the English cemetery. The whole of that district to the west of the Aventine, outside the Porta Tregemina, was occupied by granaries and warehouses for the storage of imports of all kinds. Between the northern side of Monte Testaccio and the Tiber there still exist colossal remains of the great emporium built by Marcus Emilius Lepidus and Emilius Paulus, nearly 200 years before the Christian era. In the year 1868, a considerable portion of the quays was discovered, together with some 600 blocks, many of them of large size, of rare variegated marbles of all kinds, lying just where they were landed from the galleys which had brought them from Numidia, the Grecian islands and Asia Minor fifteen centuries ago. Now, in the course of the building operations in this locality, two warehouses have been discovered, one filled with elephants' tusks and the other with lentils. It is curious to find such products stored side by side, but as bags of lentils were sometimes shipped as ballast they may have served that purpose. The discovery would have been a very valuable one, if unfortunately, the ivory had not been much decayed."

A contributor to Cosmos suggests a curious optical experiment which may serve to show the principle of the telescope. If we cut out of black paper two similar figures—two crosses, for example—and place them, their extremities almost touching, at about three inches from the eyes, before a sheet of white paper, we shall see three crosses, the middle one being dark and completely separate. This phenomenon is explained by the simultaneous vision of the two eyes, and it is easy to show this by looking at the objects successively with one eye. The experiment becomes still more interesting when, instead of black figures, we employ complementary colors—red and green, for example. In this case we must use a dark background, and there will appear a white cross in the middle.

It has long been well understood that gold is the most universally distributed of metals, being found in all parts of the world, but most readers will probably be surprised at a statement recently made by Prof. A. E. Foote, of this city, to the effect that there is more gold in the clay under the city of Philadelphia, than would equal the entire valuation of the city. In 1812, men made sixty cents a day in washing the sands near Chester, on the Delaware river, where William Penn first landed, and quite recently several dollars' worth of gold in grains were taken from a well one hundred and fifty feet deep within twenty miles of Philadelphia.—Wood and Steel.

Experiments have lately been made with a diamond of 92 carats, which is one of the finest known outside of the royal or national collections. It is of wonderfully pure water, and is admirably cut with 64 perfect geometrical facets. Its value is estimated at $60,000. When exposed during an hour to the rays of the sun, it preserved for more than twenty minutes, in a dark chamber, a

light sufficient to show the white paper that reflected its rays. The same phenomenon was exhibited, with somewhat less intensity, after having submitted the diamond to a powerful electric light. A very apparent phosphorescence was also produced by rubbing the diamond for a few moments with flannel.

Some quaint and queer mineralogical specimens were shown us by J. F. Brooks, of Tabernacle district. They were rocks, completely honey-combed with flinty cells of four sides, and gradually enlarging toward the surface. The flinty walls suggest the separation of the flinty from the lime or clay particles by crystallization. Some of the cells are filled with clay rocks. They were found by hoe and plow hands near the surface of the ground. The peculiar formation of the shell also suggests the possibility of their once having been the habitation of animalculæ akin, probably, to the coral builders. Who can solve the mystery? —Savannah News.

According to a paper read before the Philosophical Society, of Glasgow, by Mr. A. Willsamson, the total area of the coal fields of China proper is about 400,000 square miles. Both the Shansi and Heenan coal field are greater than that of the aggregate of the principal coal producing countries of Europe, and in other districts of North China the coal fields are said to be seven times larger than all those of Great Britain. The coal is of various descriptions, and it is said that iron ores are found in all parts in close proximity to the coal.

It ought to be generally known that a man's hat will serve in most cases as a temporary life preserver to those in danger of drowning. When a person finds himself in the water he should lay hold of his hat between his hands, keeping the crown close uner his chin and the mouth of the hat under water. The quantity of air contained in the cavity of the hat will keep the head above water for a long time—sometimes for several hours.

A relic of the great forests which once covered the south of Sweden was recently dug out of a bog at Kinneved, in the shape of a boat six feet in diameter, hollowed out of a log. The tree from which it was obtained must have been twenty feet in circumference. The wood, which was blue in color, was very hard, and the boat so heavy that two bullocks could not move it.

A sheet of ordinary paper, warmed in front of a fire will, in a dark place, give a very decided electric spark upon the application of the knuckle, with a crackling sound. Place a sheet of gold leaf between two sheets of paper thus electrified, and pass a pencil point over them in a zigzag course, and a luminous flash, quite strong, will appear.

The new metal, "gallium," melts at 81.1 degrees Fahrenheit, becoming liquid when held in the hand. Its specific gravity is a little less than six, or about half that of lead. It adheres readily to glass when fused and forms a beautiful mirror. It tarnishes but slightly in the air.

French engineers have succeeded in finding water in the desert country of southern Tunis. At the depth of more than 300 feet they struck a current which rushed forth from the surface with such velocity as to carry hugh stones high into the air.

The manufacture of artificial ivory from bones and scraps of sheepskin is a new industry.

MISCELLANY.

PIGMY ANIMALS.

"How is that for an elephant?" said an artist, taking a green cloth from a clay model of an elephant about twelve inches in length. "Yes. it is small," he continued, "but that's just the great point in its favor. See this bone," he continued, taking up a small object from a table—"the real bone of the elephant I am making a model of. It was the famous recently discovered pigmy elephant of Europe. Some months ago a party of French geologists, rambling through Italy, came upon great quantities of these bones, and soon identified them as those of a race of elephants that were pocket editions, so to speak. The largest were not as large as our sheep, and in the adult form, old age, much smaller than any of the baby elephants that have been exhibited in this country. Their young in turn were elephants in miniature, being about as large as a small cat, and could easily have been held upon the open palm. Herds of these pigmies were undoubtedly captured by early man, and if the circus was in existence then, we can imagine a rare entertainment. What a troupe of elephants could have been marshalled in! First would appear the great Mammoth, with its long coat of hair; then the Dinotherium, with its incurved tusks; the gigantic Gangesa, from India, with its head and enormous tusks, extending fourteen feet in front, and finally, last but not least, the pigmies and their young arousing the enthusiam of the throng of young cave-dwellers.

"The pigmies, as far as known, represented two distinct species, known to science as Elephas melittensis and E. falconeri, and their remains are found over a wide geographical area, showing that they had an extended range. In the second book of the 'Æneid' Virgil notes a tradition to the effect that Sicily was at one time a part of the mainland, and it is now believed by many that long ago Italy was connected with Africa by a neck of land and that Malta and other places, now islands, were a part of it. Over this ancient bridge the pigmy elephant is supposed to have made their way into Europe, where their tracks can be traced in many localities. In Malta most of the skeletons have been found, while others have been discovered in various parts of Italy, and among other remains in many parts of Europe. These were real pigmies, while the so-called dwarf elephants of to-day are merely elephants whose growth has been retarded in some natural or artificial manner.

"The pigmies, however, were not all elephants, as at this time pigmy horses roamed the slopes and valleys of North America. They were the ancestors of our present horse, and their remains have been found in such quantities that more than twenty different kinds have been recognized. The smallest of these pigmy horses was about as large as a fox, and differed considerably from our present horse. It lived in what has been termed the Eocene time, and is called Eohippus. Instead of walking on the tip of a single toe or hoof, as does the horse of to-day, it had four well developed toes and a rudimentary fifth. In a later bed of this same time is found the Orohippus, a pigmy horse with four perfect toes in front and three behind. A great many ages later, in beds of the Miocene time, bones of the Mesohippus appear. Then the horse was as large as a sheep—equalling in size the pigmy elephant. Its feet were still divided as it had three toes and the splint of another in each forefoot, and three toes behind. Following this came other forms, as the Anchitherium; then the Hipparion, as large as a donkey; and finally the Pliohippus, with a single toe on each foot, is found the direct ancestor of our great horse of to-

day, in the feet of which, if one carefully examines, are to be found rudimentary splint bones that are the representatives of the toes that were fully developed in the ancient forms. In Yale College a very complete set of these strange horses, from the pigmy form of long ago to the horse of today, can be seen, the result of the researches in the far West of Prof. Marsh.

"A few months ago a pigmy whale was washed ashore on the New Jersey coast, and was sent to the National Museum. In appearance it resembled the enormous finback, but instead of being sixty or eighty feet in length, and weighing several tons, it measured only nine feet in length, and was accompanied by a baby pigmy that was little over a foot long. The pigmy whales properly belong in the Pacific Ocean, and are often seen on the California coast; but this specimen probably strayed around the Horn, and with perhaps a few companions was wandering about the Atlantic, or, as some one suggested, waiting for the canal through the isthmus for a short cut home.

"Among the birds there is a pigmy quail —a delicate little creature, so small that the ancient Chinese used it to warm their hands in cold weather, carrying a bird in each closed palm. Among the quadrupeds the pigmy deer is perhaps the most interesting, and when seen it seems a perfect antelope in miniature. It is the Cephalopterus pygmæus, and is confined to South Africa—a most delicate and fragile little creature, being hardly over twelve inches in length. The head is long and pointed, the ears short, and the horns like toy ones, and very delicate and slender, being less than two inches in height, highly polished, and jet black.

"Quite as much of a pigmy is the Sultana antelope, found in the hilly regions of Abyssinia. Its height at the shoulder is only fourteen inches; the horns are extremely thin and about four inches long. The young of these midgets of the hoofed tribe are beautiful little creatures, those of the antelope being about eight inches long when born, and with their soft-colored fur, delicate pipe stem-like limbs, large and expressive eyes, they are, perhaps, the most attractive of any of the minute animals. I have," continued the artist, "nearly all these interesting creatures in my collection, and when placed together they present a striking and interesting appearance, telling a story of the curious modifications to which the various forms of life are subject. I am going to make a model of each one for a private museum, and they are to be placed in contrast with the giants. Thus the pigmy whale will be placed beside the right whale, the small elephant next to the giant-mammoth, and so on. In this way the great extremes of life are shown at a glance."—N. Y. Post.

SUNDAY OBSERVANCE.

Constance, the Great, promulgated the first Sunday law, but the day itself in this decree of the Emperor was called the "Salutary Day." And how far away is this wicked ruler's view of the Sunday from our present Puritanical and superstitious view! I give you the text of the Decree:

"Let all the judges and town-people, and the occupations of all trades, rest on the venerable day of the sun; but let those who are situated in the country, freely and at full liberty attend to the business of agriculture; because it often happens that no other day is so fit for sowing corn and planting vines, lest the critical moment being let slip, men should lose the commodities granted by the providence of Heaven."

The Sunday of the early Christians was not at all regarded as a religious day or as a holy day in any exceptional sense, and perhaps under Constantine was legally set apart as a day of rest, or rather as a fete day, in order to please the populace. So little regarded was it as a day of religious observance, that Sylvester, who was Bishop of Rome, whilst Constantine was Emperor, in order to give to the day greater solemnity, changed the name of the first day of the week from Sunday to "the Lord's day." This is the first intimation we have in history, that is authentic, that the early Church instituted the day to commemorate our Saviour's resurrection.

In the epistles of Ignatius to to the Philippians, it is stated, "that he is a killer of Christ who fasts on the Lord's day or on

Saturday;" and there is no little evidence to show that the Sunday was considered to be a day of relaxation, of joy, and rejoicing, rather than of gloom. The Pharisaical doctrine, which is now so prevalent, of keeping that day with strictness, was, among the Christians of this early period, counted to be a great wickedness.

We are told that in the fifth century, the Christians, after divine service, followed their daily employment. "It was not done" until the meeting or service was quite over, when they might with innocency enough resume them, because the length of time, and the number of hours assigned for piety, were not then so well understood as at present.

In the funeral oration for the Lady Paula, St. Jerome says, "She with all her virgins and widows, who lived at Bethlehem in a cloister with her, upon the Lord's day, repaired duly to the church or house of God, which was nigh to her cell; and after her return from thence to her own lodgings, she, herself, and all her company, fell to work, and everyone performed their task, which was the making of clothes and garments for themselves and for others, as they were appointed."

St. Chrysostom, patriarch of Constantinople, recommended to his audience, after impressing upon themselves and their families what they had heard on the Lord's day, to return to their daily employments and trades.

The Parliament of England met on Sundays until the time of Richard the Third, in the year 1483.

Many of the kings were crowned on Sunday, among whom were Rufus, Stephen, Henry II., Richard I., and John. Richard I., was crowned twice,—once in the beginning of his reign, and again upon his return from the Holy Land,—and both times on Sunday. The daughter of Henry II., was on Sunday crowned Queen of Sicily, at Palermo. King John was first inaugurated Duke of Normandy, and afterwards crowned king, each event transpiring on Sunday.

The first law of England made for keeping of Sunday, was in the time of Edward VI., about 1470. "Parliament then passed an act by which Sunday and many holy days, the feast of All Saints, of Holy Innocents, &c., were established as festivals by law. This provided also, that it should be lawful for husbandmen, laborers, fishermen and all others in harvest, or any other time of the year when necessity should require, to labor, ride, fish, or do any other kind of work, at their own free will and pleasure upon any of the said days,"

In the morning of Sunday, the churches and chapels were opened the after part of the day was devoted to rational enjoyments this was not confined to the Roman Catholics. The Waldenses and other separatist sects observed that order. John Calvin, himself a most narrow minded and intolerant thinker, and the real founder of modern orthodoxy, made no claim that the Puritanical observance of the Sunday was in accordance either with the teaching of Christ or the usage of the early Christians. He explicitly writes in his great theological treatise, "The Institutes:"

"But it cannot be doubted that everything was abolished at the coming of Christ our Lord. For He is the reality, at whose presence all types vanish; the substance, at whose sight all shadows are forsaken; He, I say, is the true fulfillment of the Sabbath. Being by baptism buried—with him, we have been grafted into a share of his death, that, being partakers of the resurrection, we should walk in newness of life. Therefore, the apostle in another place says, that the Sabbath was the shadow of something future,—that in Christ is the body; that is, the solid, real substance, which in that place he has well explained. This is content, not with one day, but with the whole course of our life, until, being wholly dead to ourselves, we are filled with life of God. Far, therefore, from Christians ought to be the superstitious observance of days."

Luther, whom the orthodox so patronizingly quote as authority, called the strict observance of the Sunday an apostacy from Christ, and recommended that the people attended church in the morning, and then give the remainder of the day to recreation. The Catholic countries, and, indeed, all continental Protestants, observe the Sunday about in the Spirit which Luther taught.—Robert Laird Collier.

A BOOS-KE-TAN.

The Creek Indians of the Hickory Ground town or neighborhood held their annual "boos-ke-tan" last week. This is commonly called "busk," and is the occasion when all the Indians of a certain section, under a local chief, meet for the purpose of taking their "possan" or black drink. The ground is selected by the town chief near some running stream, and a brush shed is constructed in the form of a cross, one end to the north, one to the south, and the others to the east and west. The chief occupies the west end and his subordinate officials the ends to the other points of the compass. After everything is got in readiness, a committee is appointed to go out and bring in four round logs, which are placed with ceremony in the center of the arbor, the outer ends pointing to the four cardinal points, but all touching together in the center.

Fire is produced by friction, which is then placed in the center of this cross. It is estimated with a slow fire these logs will last four days, the usual length of the busk. After the black drink is made the women, who are fasting, dance around the fire, and from twelve o'clock to the middle of the afternoon take draughts of the medicine, which is a powerful emetic, and also wash their faces, hands and feet with it. When the women all get through the men join them, and they dance all night, the women wearing terrapin shells filled with gravel and bound together, with buckskin thongs fastened to their legs or ankles, which rattle and aid in keeping time in the dance. They sing their peculiar songs, interspersed with yells by the men, and it is wonderful the amount of labor that is endured during these exercises. The women are tastefully and brilliantly dressed and decorated with their finest clothes, ribbons and ornaments. The next day the men go through pretty much the same ceremonies, and take their medicine.

After this, on the third day, the women bring the children, who are made to drink. They are washed in it, scratched on the arms and legs with a scratcher of many points, so the medicine can the sooner penetrate. These scratchers are usually made of garfish teeth, or in the absence of those they are made by sticking numerous pins through a feather. After each class get through with their duties of drinking and dancing they are permitted to go to the stream and bathe, when they can return to the camp and partake of food and prepare for the dance at night. During all these ceremonies the women and children occupy one camp and the men another.

On the fourth day the ashes are all cleaned up, and each participant sprinkles some of it on himself, the fire is renewed, and then begins the final dance. The men all come in with sticks, in the ends of which are inserted four white feathers. With these they keep time in all sorts of motion during the dance. All this is the ceremony that has to be gone through with before any of the members are allowed to eat green corn, and is, properly speaking, the "green corn dance."

In some towns of old standing these ceremonies are kept up eight days with much formality and strictness. In Tookabatcha town there now exist brass plates that have been handed down from one generation to another, probably for hundreds of years. They are now in possession of old Captain Tookabacha Hajo, one of the finest looking old Indians I have ever met, and is said to be one of the best men throughout the territory. These meetings are not altogether for the purpose of taking medicine, but are productive of much good. The chiefs of these clans take occasion to call together all the young men and explain to them the laws of the country and exhort them to be obedient to these laws, to maintain friendship among themselves and neighbors, and all return thanks for the blessings of the past year and ask the Great Spirit to continue them for the year to come.—[Muscogee (I. T.) Cor. N. O. Times-Democrat.

ABOUT PERFUMES.

It does not follow nowadays, says the New York Sun, because a toilet perfume is made in France or any other foreign coun-

try, that it is superior in quality to one of American preparation. Such was formerly the case, but the art of making fine perfumes has been carried to such perfection of late years in this country that not more than one-eighth as much of the French preparation is sold in the United States to-day as was sold ten years ago. While the best American-made perfumes are equal in quality to the finest of the French, such could not be the case if we had not that country to depend upon for our essential oils. The flowers that lead as providers of popular perfumes for the handkerchief and toilet are the jasmine, violet, tuberose, rose, bitter orange flower and cassia. Combinations of these with ambergris and musk result in all the delicious perfumes that are used. These flowers, or most of them, are indigenons to the south of France. Cassia, the blossom of the cinnamon tree, comes from the East Indies, as does the tuberose. The oils of violet, tuberose, jasmine and other delicate flowers, being volatile, must be extracted in a peculiar manner. in order that they may be retained any length of time for use. The oils of these flowers are extracted and held by grease absorption. A layer of refined fat is spread upon a large wire sieve with small meshes. Upon this bed of grease the delicate petals of the odor-bearing flowers are scattered loosely. Then a layer of fat is spread upon the flowers, and then more petals, and so on until the sieve is filled. It is then covered up and subjected for ten or twelve hours to a temperature just below the point at which the fat would melt. Then the heat is increased until the fat becomes liquid and runs through the meshes of the sieve into a vat arranged to receive it, charged with the perfume of the flowers. The grease, holding the rare oils of the flowers, is then sealed in cans and is ready for market, which it finds all over Europe and in this country. The trade name of the grease is pomade extract. In preparing the perfumes for use the manufacturer treats the pomade with odorless alcohol. The alcohol becomes the affinity of the perfume held by the grease, and it readily leaves the latter and joins the spirits. The grease is still there, however. To remove it from the affiliated perfume and spirits the compound is subjected to a gradually lowering temperature until the grease congeals. It is then an easy matter to run the liquid off, and all that is left to do is to bottle it, cork and label it, and it is then ready for any lady's handkerchief. Bitter orange flowers, rose leaves, cassia and other perfumed flowers have fixed essential oils, which are obtained by distillation. The neroli oil of trade is obtained from bitter orange blooms. About $5,000,000 worth of toilet perfumes are sold here every year, the basis for the most of which is imported. In spite of the assertions that the blooms of Florida are as rich in fragrant oils as the French flowers, experimental distillation has not made the assertion good except in the case of the oil of bitter orange flowers. As to roses, in France 100 pounds of rose leaves produce a dessert spoonful of essential oil. In America it requires a ton of leaves to produce the same quantity. Then, again, flowers can't be picked by machinery,. and it is not at all likely that floriculturists in this country could secure hands to gather their fragrant blossom harvests for two cents a day, as they can in France. Cologne and toilet waters of all kinds have been so successfully prepared in this country during the past few years that a large export trade in them has gradually developed. As colonge is simply refined, odorless alcohol, perfumed with some essential oil of flowers, there is no reason why it should not be made as well here as elsewhere. All first class toilet waters, with the exception of bay rum, are nothing more nor less than perfumed corn spirits, which have received a medicinal quality by the introduction of balsamic or tonic properties. Genuine bay rum is always imported. Nine-tenths of the stuff used as bay rum is not bay rum at all, but a mixture of the essential oil of bay with common rum or alcohol.

REYNARD'S WAYS.

During the fall of 1869 I witnessed the very shrewd performance of an old fox that had given me the "dodge" for at least a

half dozen times. I was a boy then, but I kept as fine a pack of dogs as Middle Georgia afforded. Two of my cousins, living near my father's, also kept a number of splendid hounds. We hunted together, and the sounding of one horn brought all the dogs together. We rarely failed to catch a fox if we could once strike his trail; but the one under consideration had succeeded in worrying us not a little. We always lost the scent at the same place. After running for an hour or more, and allowing the dogs to come very close on her, she would make the circuit of a small mountain, and start directly from that to another on the opposite side of the little creek, but the dogs invariably failed to carry the trail more than thirty or forty rods from the stream. Her bridge was a large pine log that lay across the creek, fifteen or twenty feet above the water. The banks were very high.

One fine frosty morning, after a race after her that terminated as all the others had done, it was decided that the next Monday morning—this was Saturday—the other boys were to proceed with the dogs to the "striking" ground and that I should make for the pine log at once and watch for the trick. Our plan was carried out and the secret discovered.

I took my position on a knoll about one hundred yards from the log, with it in plain view, and waited for developments. The "string" ground lay one mile west of my post, and I had just begun to feel like nodding, when I heard Forest, one of the truest and best foxhounds it has ever been my lot to know, strike the keynote, and pretty soon the game was up, and the whole pack of eighteen in full cry, came sweeping around the base of Anawaka Mountain. It was a clear, calm morning with a gentle breeze from the west, and every note was borne to my ravished ear. There were four or five dogs in the pack with a liberal supply of English deerhound blood in their veins, and they sounded the bass notes grandly. The very thick cover of brushwood gave the fox a decided advantage, and one turn around the mountain gave her the lead by at least a half mile. I was listening ahead, when on the top of the ridge across the creek, and directly in front of me, I saw the fox dash into view, clear the little strip of tableland at a few bounds, run across the creek on the old pine log, and make straight up the little knoll on which I sat as motionless as a statue, whirl directly back, after coming within ten feet of me, recross the creek on the same log, leap as far off the log up the creek as she could, and lie as flat as a fox could on bare ground.

I sat still to watch her panting sides and await developments. In a few seconds, on came the pack in full cry led by Alec, a fine young dog of my cousin's. They dashed across the creek, passed me in a twinkling, despite my frantic efforts to turn them back. Casting my eye back to see what had become of the game, I caught one glimpse of her scuddling back toward the mountain on the line she had just come over a few minutes before. Here was the trick. I knew her secret, and as soon as the over-eager hounds had satisfied themselves, that they had been duped by the wily brute, and had come back to strike the scent anew, I succeeded in explaining the trick to them, and in forty minutes after the dodge, around her breathless body, I explained it to the other boys.—J. C. W., in Forest and Stream.

THE COUNTRY OF STILTS.

A writer in Macmillan's Magazine, speaking of the quaint region known as the Landes, says: One need not ask why, since the collection of resin has been one of the chief industries of the Landes, wild creatures of all kinds have become much scarcer than formerly throughout this region, which is still very attractive to the adventurous sportsman, especially if he be likewise a naturalist. The resiniers have had a great deal to do with driving the wolf back to the Pyrenees, not so much by making war upon him as by worrying his nerves by the incessant tapping of the axes. A wolf has a delicate nervous system. A line of railway run through his district is quite sufficient to make him move elsewhere. The boar, a less nervous animal than the wolf, and a more formidable one when attacked,

is frequently met in these forests. He has nothing to fear from the resiniers, who, when they see him, have the prudence to let him go on his way, and they treat his spouse, when followed by her young, with even greater respect. If the boar, on the other hand, becomes imprudent and makes nightly raids on a maize field on the outskirts of a village, the villagers organize a hunt. His taste for sweet maize stalks frequently costs him his life; but he sells it dearly, ripping open dogs and sometimes men, fighting as long as he has strength to strike with his tusks. Curiously enough the boar has a rival here in his congener, the domestic pig, which, having found the air of the forest and freedom sweeter than that of the sty or farmyard, became a self-emancipated poker.

A few years ago these wild pigs—they are known as cochon sauvages—were so numerous in the neighborhood of Cazau and wrought such destruction upon the young pines that the government took energetic measures to exterminate them. The wild pig of the Landes is of the same breed that supplies Paris with its much-prized Bayonne hams. Formerly troops of wild horses roamed the Landes, just as wild horses and cattle roam the Carmargue—the desert of Providence and Languedoc. They have entirely disappeared. Roebucks, which were once plentiful, are getting scarce. Smaller quadrupeds, such as foxes and hares, are very numerous, and the wildcat is found in the forest. The Landes are peculiarly rich in ornithology. Birds which have almost, if not quite, disappeared from other parts of western Europe, such as bustard, the wild goose, and the wild swan, linger in their solitudes. Flamingoes are occasionally seen in districts where the marshes have not been drained, and there are wild pheasants about the banks of Leyre. There are tortoises in the sand, and the lakes contain a great variety of fresh-water fish. Sportsmen to whom the pleasure of shooting something in old Europe that is really wild is heightened by natural obstacles, such as thickets that can only be penetrated by means of an axe, sand sloughs into which they may step unawares and not be heard of more, and forest flies capable of inflicting positive torture, would find in the Marensin, the district immediately south of Lake Cazau, an ideal hunting-ground. If the visitor takes out his shooting license at the mairie of commune which he chooses for the scene of his exploits, he may blaze away without fear of hindrance; but it is necessary that he should pay this local tribute, for the commune has the right to stop people from shooting within the bounds unless they are provided with one of its own licenses. The license costs 25 francs. Half of the money goes to the commune in which it is taken out, and the other half to the state.

DIAMONDS.

Diamonds are chiefly found in India and Brazil. They are also found in Malacca, Borneo, Algiers, Australia, Russia, and in some portions of our own country. The first diamonds that were known to the traders in precious stones in Europe, were brought from Vasapoor and Golconda. The discovery of the mine in the latter place, is attributed to a poor shepherd, who, while tending his flocks, stumbled upon what appeared to him a pretty pebble. This stone he gave in exchange for some rice to a man as poor as himself. After passing through several hands, it fell into those of a merchant, who knew its worth, and who, after diligent search, succeeded in finding the mine. Having made excavations he found a reddish earth, mixed with pebbles, and intersected by white and yellow veins, resembling lime. The diamond mines of Brazil were discovered by a curious circumstance, in 1630. Some miners in searching for gold found some curious pebbles, which they carried home to their masters as curiosities. Not being considered of any value, they were given to the children to play with. An officer who had spent some years in the East Indies saw these pebbles, and sent a handful to a friend in Lisbon to be examined. They proved to be diamonds. A few were collected and sent to Holland, and were pronounced to be equal to those

of Golconda. The news soon reached Brazil and those who possessed any of the "pebbles," soon realized large sums of money. The Portuguese Government laid a claim upon all diamonds that might be found thereafter, and a search was made and mines discovered. The diamond is so rare and valuable, it is only carbon or charcoal in its purest state, and can be consumed by fire at a less heat than that required for melting silver. Nature's process for concentrating or crystalizing this substance remains a mystery. The numerous attempts to produce diamonds artificially, have not as yet turned out successfully. It is the hardest of all known substances, and the purest and most brilliant of all gems. It varies in color from red, blue, yellow, green, brown, gray, and even black. It is always found crystalized, and in its natural state, the surface is dull and uneven. The ancients were very familiar with the gem, though entirely unacquainted with the method of cutting or polishing it. The four large clasps of the monarch Charlemagne's mantle still preserved in Paris, consists of diamonds in their rough state.

A QUEER WAY TO GET FRESH WATER.

In the Persian Gulf is a place called Babrin, where men go a-fishing for drinking water. So, at least, a sailor who has been there told a writer in the Sun.

"I don't know who discovered the fact, but there are numberless springs of ice-cold water at the bottom of the gulf near the shore, where the water is about sixty feet deep. This must have been known when they first set up the town, of course, or it wouldn't have been started there. This water gets salt enough, though, before it gets from the bottom, and so they have to send down after it. When a man's wife calls him to go after a pail of water, and be quick about it, over in Babrin, he grabs a goat-skin bag, yells at the first neighbor he sees stretched out in the sand, and the two jump into a boat and row out a short distance. The man who is after the water wraps the goatskin around his left arm, with the mouth of the bag in his hand. Then he takes into his other hand a heavy stone. This stone is tied securely to the end of a long and strong line, for stones are valuable property there. Without them no one could go out and fetch a pail of water, and they are very scarce. With the stone firmly clutched in his hand the man dives into the water, and down he goes to the bottom. When he reaches the cool, fresh water gushing up from the sand he opens the mouth of his goatskin bag, drops the stone and floats upward in the strong current. The bag quickly fills and the mouth is closed again.

"When the man reaches the surface his companion lifts the bag into the boat, and the diver follows. The stone is then carefully drawn up, and the men go home.

"The water is cold and refreshing when it comes up from the depths of the sea, but it soon gets flat and warm. The more you drink of it the thirstier you get, but the natives can get along on a few swallows of it now and then. The requirements of the climate keep the divers at work in the submarine springs for all they are worth, and the shore is lined with their boats all day long. These springs are said to be the outlet of large natural aqueducts in a range of mountains more than 500 miles from the coast, but I guess they would have a hard time to prove that theory if they were called upon to do it."

THE FIGHTING INSTINCT IN MAN.

There is not the slightest certainty that any invention, however terrible, would put an end to war; while there is almost a certainty that if such an invention were perfected, it would grievously increase the miseries of mankind. Taken in the lump, men will face any means of destruction whatsoever, if also they possess it themselves. Give two men pistols, and they will fight across a handkerchief. They are not afraid of death, but only of death without a chance of victory. King Theodore of Abyssinia asked his courtiers, when the rocket sticks fell at his feet, if he could reasonably be expected to face things like those, and ultimately, in pure despair of defeating sci-

ence with unscientific weapons, killed himself; but if he also had posessed rockets, he would have fought on. No men, not even Prussian soldiers or English sailors, will face shells without shells to throw back; but when they have shells they face the enemy's shell as bravely as they did the old round shot. The methods of war are changed by science, but war is not extinguished. Suppose it true that able chemists and mechanicians could invent a method of throwing asphyxiating vapor on a sleeping army, what would be the result? First, the adoption of some protective covering, such as iron-clad huts for sleeping in; next, the adoption of a method of encamping which would spread the army over a surface too great or too uneven to be reached; and next, the use of such devices as were used by the assailing force. Huxley would march with his fishermen to choke Tyndall and his Alpine climbers. War would then consist mainly of efforts to obtain advantageous positions, from which showers of death would be thrown, but war would not cease. Forlorn hopes would be organized among chemists or mechanicians as easily as among soldiers, enormous rewards would be paid to the new warriors, and nations would fight each other as briskly as ever.—London Spectator.

CRINOLINE IN CLASSIC DAYS.

The Frankfurter Zeitung contains an interesting article on the origin and history of that revived monstrosity, the crinoline. Like many other devices which we are accustomed to regard as comparatively modern, the crinoline seems, in reality, to be exceedingly ancient. Hesiod, who wrote in the eighth century before Christ, must have observed something of the kind, for he advises young men not to be led astray by certain women of his day, who wore their clothes puffed out behind. For more than twenty centuries after Hesiod's time, however, the crinoline languished in obscurity; and it was not until after Queen Elizabeth had come to the throne of England that the farthingale became fashionable. The farthingale, or vertugade, which served to extend the skirts of the ladies of quality, who were Shakespeare's contemporaries, is described as having been made of hair and wadding. In the eighteenth century whalebone generally took the place of these cumbrous materials, but already iron or steel hoops were in use in England, and, covered with silk and cotton, steel hoops won their way to universal favor until, a few years ago, they were partially superseded by folds of highly starched muslin. If "dress improvers" were actually worn by the Greek women of Hesiod's day, it is not improbable that they were also worn 200 years earlier, and that Helen, when she fled with Paris to Troy, wore some primitive kind of crinoline.

A SINGULAR HAVEN IN THE SEA.

It is said that a singular spot exists in the Gulf of Mexico, some ten miles to the southward and westward of Sabine Pass, a mile or so in diameter, upon the surface of the sea, which looks like all the rest of the Gulf during calm weather, but when the wind freshens to a gale and the waters about it become agitated, takes on a reddish color and becomes thick and muddy. The place has been called the "oil pond" that, while there may be a tremendous sea running all around the place within the circle of surf the water is comparatively quiet, and vessels which otherwise would be blown ashore or swamped, can there ride out the heaviest storms in safety, and have done so in hundreds of instances. The water is about twelve feet deep, and a pole can be pushed twenty-five or thirty feet through the soft and peculiar mud forming the bottom. This mud is different from anything on the coast, of a soapy character, and of remarkable cleansing properties, being often used to clean the decks of coasting vessels. The oil which renders the surface of "the pond" so smooth is supposed to come from the mud at the bottom, and many think there are deposits of petroleum not far from the surface, but of this I know nothing. Providence has thus provided a safe shelter for small craft out in the open sea, for the "oil pond" once reached during a gale is just as

safe as a vessel lying under the lee of a lee wharf in Gaveston harbor.

THE INVENTION OF INK.

When ink was first introduced does not seem to have been decided, but given the paper and the pen, a colored medium which would show on a light surface was so obvious a want, and one so readily found, that there is no extraordinary credit due to the unknown inventor. It appears to be only of comparatively late years that black ink has been almost universal. Roman ink was red, purple and gold, and inks of blue, green, violet, and other shades were not uncommon. It is said that, simple as is the composition of ink, "we possess none equal in beauty and color to that used by the ancients; the Saxon manuscripts written in England exceed in color anything of the kind." Modern ink makers will deny the superiority of the ancients; but who shall say whether words written in the ink manufactured to-day will stand as vividly centuries hence as those Saxon manuscripts have stood? It is difficult to see how the writing materials of the present day can be improved upon, for convenience at least, setting aside questions of lasting inks, which the generation that uses them cannot settle. Paper, rough and smooth, fluent inks of any color that the writer may believe suitable to his eyes, pens as fine as a needle or as blunt as a spade, are all to be bought in every street. The great lack of the age seems to be ideas at once more novel and sensible in the record of which these serviceable materials may be employed.—[London Standard.

CANINE ATTACHMENT FOR A HORSE.

A horse which once attracted great attention in the streets of New York fell lame and was sent to the country. There he formed the acquaintance of a dog—a cross between the St. Bernard and Newfoundland—and the two soon became very fond of each other. When the horse died straw was spread over his body until a pit could be dug. The dog seemed to be disconsolate. He ran off to a neighbor's house where his brother had a home, and an hour later the two dogs were seen to approach the carcass. They carefully removed the straw from the body, squatted down, one at the head and the other at the tail, and howled mournfully, then recovered the remains and crept silently away. The workmen who witnessed the scene were strangely moved by it, and they insist that it was one of the saddest and most touching of ceremonies. The dead was placed out of sight, but the dog often paid a visit to the grave. Some of the attachments formed in the animal world are not only strong, but marked by a high order of intelligence.—Turf, Field and Farm.

COLLEGE MEN IN LITERATURE.

Disputants about the value of college education have drawn up the following lists of eminent names and given them to the public to say which is the greater:

NOT COLLEGE GRADUATES.	COLLEGE GRADUATES.
Walt Whitman	Longfellow.
Whipple	Willis,
Trowbridge	Hale.
Field	Ticknor.
Parton	Motley.
Bayard Taylor	R. H. Dana, Jr.
Eggleston	Joseph Cook.
Harte	Emerson.
Howells	Hawthorne.
James	Robert Grant.
Aldrich	Lowell.
Lathrop	Lodge.
Stockton	Holmes.
Piatt	Prescott.
Cable	Bancroft.
Crawford	Stimson.
Fawcett	Prentice.
Gilder	Alden.
Harris	McMaster.
Carleton	Warner.
Mark Twain	D. G. Mitchell.
Stoddard	Stedman.
Burroughs	John Fisk.

A NEW USE FOR TOADS.

The latest and most ingenious way of getting rid of roaches and water bugs we have heard of, says the Scientific American, is related of a citizen of Schenectady, whose kitchen was infested with them.

A servant, hearing that toads were an antidote, caught three ordinary hop toads, and put them in the kitchen. Not a roach or water bug, it is stated, can now be found in the house. The toads have become domesticated, never wander about the house,

and are so cleanly and inoffensive that there is no objection to their presence.

Another use for toads is to employ them for insect destroyers in the garden. They are determined enemies of all kinds of snails and slugs, which it is well known can in a single night destroy a vast quantity of lettuce, carrots, asparagus, etc. Toads are also kept in vineyards, where they devour during the night, millions of insects that escape the pursuit of nocturnal birds, that might commit incalculable havoc on the buds and young shoots of the vine. In Paris toads are an article of merchandise. They are kept in tubs, and sold at the rate of two francs a dozen.

CURRENT LITERATURE.

Phonetics.

THE COMPLETE PHONETIC ALPHABET, ETC. Edwin Coombs. A. J. Graham, N. Y.

This book is one of the outgrowths of the spelling reform movement—a movement which is gaining strength very rapidly in these days. Those interested in the matter will find much of value in Mr. Coombs' work, and those who think it impossible to devise an alphabet to take the place of our present unscientific one will be surprised to discover the problem so nearly solved in this little book. In the words of a late reviewer, it may be said: "In this and in various other matters Mr. Coombs' book gives evidence of an amount of care and laborious attention to detail, which happily supplements the ripe scholarship and thorough familiarity with phonetic principles manifested in its pages. On the whole it is not too much to say that "The Complete Phonetic Alphabet" is a work which no one interested in the correct representation of English speech can afford to neglect reading."

Political History.

AMERICAN CONSTITUTIONS. THE RELATIONS OF THE THREE DEPARTMENTS AS ADJUSTED BY A CENTURY. By Horace Davis, Baltimore, N. Murray (Johns Hopkins' University), 1885.

This is one of the series of "Johns Hopkins' University Studies" now in course of preparation. In common with all the books in this series, the present one represents adequate scholarship and original thought. To one acquainted with the voluminous literature of the subject it may seem impossible to compress a just and fair treatise within the limits of a brochure of seventy pages; and yet so far from being trivial or a mere outline it is philosophical and comprehensive to a remarkable degree. Any attempt to characterize the work within the limits of a mere notice would be worthless. At a later day a review will be attempted.

Santitation.

A GUIDE TO SANITARY HOUSE INSPECTION, OR HINTS AND HELPS REGARDING THE CHOICE OF A HEALTHFUL HOUSE IN THE CITY OR COUNTRY. By W. P. Gerhardt, Sq. 16 mo. Cloth. Price, $1.25. New York: John Wyley & Sons, 1885.

This book is an attempt to outline a practical method of sanitary house inspection. The author abounds in good sense, and his little book is a vade mecum to those who regard health as one of the desiderata of housekeeping. Its suggestions are all practical and, without making any pretentious claims, it embodies the latest results of sanitary science, free from technicalities and "cranky" notions.

Evolution.

EVOLUTION IN HISTORY, LANGUAGE AND SCIENCE. Four addresses delivered at the London Crystal Palace School of Art, Science and Literature. Price 15 cents, post free. J. Fitzgerald, Publisher, 393 Pearl street, New York.

This interesting work forms a valuable addition to the series of popular scientific works known as the "Humboldt Library." The number of works published in that series now amounts to seventy, including many of the most celebrated writings of Huxley, Spencer, Tyndall, Darwin, and others.

Astronomy.

PUBLICATIONS OF THE WASHBURN OBSERVATORY. Vol. III. Madison: Wisconsin State Printers. 1885.

The University of Wisconsin has a reputation for physical studies not excelled in the West. In astronomy, especially, it has reached undisputed eminence through the valuable labors of Prof. Holden, as Director of the Washburn Observatory. The publication before us gives the results

of observations of the 303 fundamental stars for the southern zones of the Astronomische Gesellschaft.

Other Publications.

THE INTER-OCEANIC PROBLEM AND ITS SCIENTIFIC SOLUTION. An address before the A. A. A. S. at Ann Arbor. Elmer L. Corthell, C. E. 1885.

CATALOGUE OF PHAENOGOMOUS AND VASCULAR CRYPTOGAMOUS PLANTS OF NORTH AMERICA. By Dr. J. H. Oyster, Paola, Miami Rep. Print. 1885.

THE SHELLS OF PETTIS COUNTY, MO. By F. A. Sampson, Sedalia: F. H. Reynolds. 1885.

VOICE OF SINGERS. By Carl H. Von Klein, A. M., M. D. Columbus, O.: Ham & Adair. 1885.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. XXXIII Meeting. Parts I and II. Salem. 1885.

BULLETIN OF THE ILLINOIS STATE LABORATORY OF NATURAL HISTORY. Vol. II. Art. III. Parisitic Fugi of Illinois. Part I by T. J. Burrell, Peoria. J. W. Franks & Sons. 1885.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY. Vol. XXIII, Part I: Boston. 1885.

BULLETIN OF THE SEDALIA NATURAL HISTORY SOCIETY. Sedalia. W. H. Reynolds. 1885.

ANNUAL REPORT OF THE KANSAS CITY PUBLIC SCHOOLS, 1884-5. Kansas City: P. H. Tiernan. 1885.

Some Titles From The Magazines.

"Atmospheric Electricity." P. H. Vanderweyde, M. D. The Electrician and Electrical Engineer for October.

"Abraham Lincoln in Illinois." E. B. Washburne. North American Review for October.

"America and the Vatican." W. W. Astor. Same.

"Actinic and Visal Focus in Photo-Micrography with High Powers." Jacob D. Cox. American Microscopical Journal for October.

"Ancient Canals on the South-west Coast of Florida." A. E. Douglas. The American Antiquarian and Oriental Journal for October.

"A Biography of the Halibut." C. Brown Goode. The American Naturalist for October.

"Campaign of 1861-2 in Kentucky, Unfolded through the Correspondence of its Leaders." (First Paper.) Gen. Wm. Farrar ("Baldy") Smith. Magazine of American History for October.

"Crystalline Rocks of Alabama." C. H. Hitchcock. The American Journal of Science for October.

"Cope's Tertiary Vertebrata." J. L. Wortman. Same.

"Clinical Aspect of some Disorders of the Gastro-intestinal tract of the Horse." Thos. B. Rogers, V. S. The Journal of Comparative Medicine and Surgery for October.

"Camping Tour to Yosemite Valley." I. L. Kephart, D. D. Microcosm for October.

"Chemistry of What we Eat." Henry A. Mott, Ph.D., etc. Same.

"Commensurability of Motions." Prof. Asaph Hall. For. Assoc. R. A. S. The Observatory (English) for October.

"Comparison (A) of British and Metric Measures for Engineering Purposes." Arthur Hamilton-Smythe B. A.. etc. Van Nostrand's Engineering Magazine for October.

"Cylinder Condensation in Steam Engines. An Experimental Investigation." Chas. L. Gately and Alvin P. Kletzsch. The Journal of the Franklin Institute for October.

"Crumpling of the Earth's Crust." W. B. Taylor. American Journal of Science for October.

"Dogs (The) of Æsculapius." A. C. Merriam. The American Antequarian and Oriental Journal for October.

"Device for Testing Refractive Index." (Illust.) The American Monthly Microscopical Journal for October.

"Efficiency (The) and Duration of Incandescent Lamps." (Illust.) The Electrician and Electrical Engineer for October.

"Electrical Furnace and the Reduction of the Oxides of Boron, Silicon, Aluminum and other Metals by Carbon." E. H. and A. H. Cowles, and C. F. Mabery. American Journal of Science for October.

"Emmerich's So-Called 'Naples Cholera Bacteria.'" The Journal of Comparative Medicine and Surgery for October.

"Electric Conductivity of Metals and their Alloys." M. Lazare Weiler. Van Nostrand's Engineering Magazine for October.

"Early (The) Study of Plants." Eliza A. Youmans. Popular Science Monthly for October.

"Energy (The) of Life Evolution." Prof. E. D. Cope (Illust.) same.

"Fallacy (The) of 1787." A. W. Closon. Magazine of American History for October.

"Grant's Military Abilities." By a Confederate officer. Rev. H. W. Cleveland. Same.

"Geometrical Form of Volcanic Cones and the Elastic Limit of Lava." G. F. Becker. American Journal of Science for October.

"George Elliot's Private Life." E. P. Whipple. North American Review for October.

"How Plants Grow." H. W. S. Worsley-Benison, F. L. S. The Journal of Microscopy and Natural Science (English) for October.

"Human and Bovine Tuberculosis." J. M. Heard, M. R. C. V. S. The Journal of Comparative Medicine and Surgery for October.

"How to Quell Mobs." Fitz-John Porter. North American Review for October.

"Helen Hunt Jackson." Jeanne C. Car. The Woman's Magazine for October.

"Homes (The) of the Oneidas." Rev. W. M. Beauchamp. Magazine of American History for October.

"Inhuman Crimes in England." Cardinal Manning. North American Review for October.

"Interbond of the Seen and Unseen." Collected by the author of "Scientific Materialism." The Journal of Science (English) for October.

"Letters and Recollections of Grant." Admiral Ammen. North American Review for October.

"Mythic Dry Painting of the Navajos." W. Matthews. The American Naturalist for October.

"Madmen and Madness at Rome." The Journal of Science (English) for October.

"Microscopic (The) Structure of Iron and Steel." F. Lynwood Garrison. The Journal of the Franklin Institute for October.

"Microscope (The) and How to Use It." The Journal of Microscopy and Natural Science (English) for October.

"New (The) Star in the Great Nebula of Andromeda." E. W. Maunder, F. R. A. S. The Observatory (English) for October.

"On the Supposed Germinating Powers of Mummy-Wheat." Henry King-Parks. The Journal of Science (English) for October.

"Origin (The) of the Utes. A Navajo Myth." W. Matthews. The American Antiquarian and Oriental Journal for October.

"Observations Upon the Tertiary of Alabama." T. H. Aldrich. Journal of Science for October.

"Port Royal (The) Expedition, 1861. The First Union Victory of the Civil War." Brig.-Gen. Egbert L. Viele. Magazine of American History for October.

"Pseudocyclosis (The) In Amœba." G. C. Wallach, M. D. American Monthly Microscopical Journal for October.

"Prehistoric Cities of Central America." (Illust.) L. P. Gratacap. The American Antiquarian and Oriental Journal for October.

"Pond Life II." W. E. Hoyle, M. A., etc. The Journal of Microscopy and Natural Science for October.

"Physical (The) Basis of Phenomena." H. H. Bates. Van Nostrand's Engineering Magazine for October.

"Relations (The) of Mind and Matter." (Continued.) Chas. Morris. The American Naturalist for October.

"Study (A) of Recent Earthquakes." M. A. Daubree. Popular Science Monthly for October.

"Second Law (The) of Thermo-Dynamics." J. Burkitt Webb. (Illust.) Van Nostraud's Engineering Magazine for October.

"Taensa Grammar and Dictionary" (The). D. G. Brinton, M. D. The American Antiquarian and Oriental Journal for October.

"Trading Rat. (The)" Mrs. E. E. W. Hatch. The Popular Science Monthly for October.

"Traces of Prehistoric Man on the Wabash." Jno. T. Campbell. The American Naturalist for October.

"Three New Portraits of Washington. Composite Photography." (Illust.) W. Curtis Taylor. The Journal of Franklin Institute for October.

"Water Supply (The) of Ancient Roman Cities." Prof. W. H. Corfield. Van Nostrand's Engineering Magazine for October.

"White Ant (The) A Theory." Prof. Henry Drummond. (Illust.) The popular Science Monthly for October.

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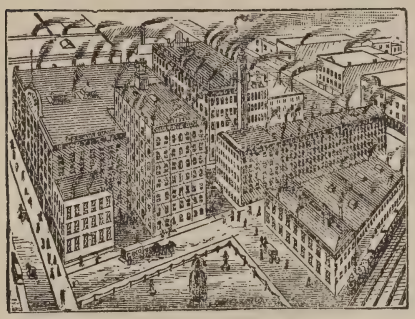
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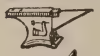
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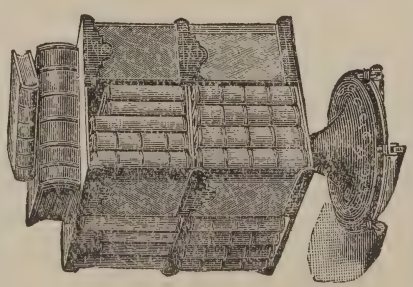
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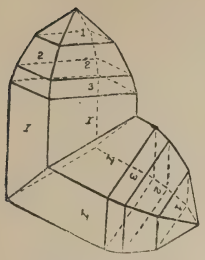
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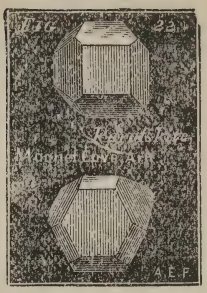
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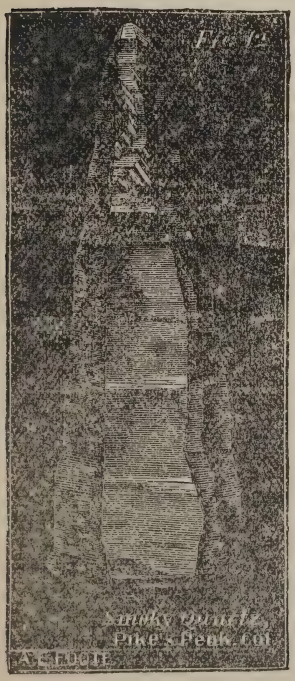
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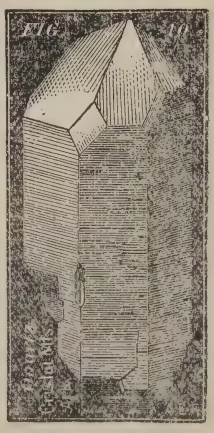
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CONTENTS:

PAGES.

A Chinese Columbus, II. W. W. 212
Herbert Spencer's Essay on Religion. II. NATHAN C. KOUNS 216
Evolution in the Orchards. E. P. P. 222
The Khetshua (Qquetchua) Language. A. S. GATSCHETT 227
Progressive Electric Railways. W. W. 230
Pre-historic America. EDWARD CLODD 236
Native American Dogs. A. S. PACKARD 239
Dickens and Thackeray. R. A. PROCTOR 243

EDITORIAL: The New Stars—The Taensa—The American Antiquarian—Tuberculosis in Cattle—Antiquity of Man, etc 253

SCIENTIFC AND INDUSTRIAL NOTES: A Mathematical Theory of Evolution—Phosphorus—A Modern Mound Builder—The Fuegian—Use of Spines in Cactuses—Weather Report for October—St. Louis Observatory—Experiments with a New Explosive—Immortality of Unicellular Organisms—The Philosophy of Flame—A Remarkable Man—Sand Dunes—Origin of the Diamond—Land Birds at Sea—The Axoolti—The Carboniferous Age—Science Leads to Economy of Time and Labor 255

MISCELLANY: The Gortyna Tables—A Slave to the Stars—Visit to a Shot Tower—Some Olden Time Peculiarities of Mens' Dress 267

CURRENT LITERATURE: Political Economy—Natural History—History—Reference Books—Poetry—Other Publications—Some titles from the Magazines 271

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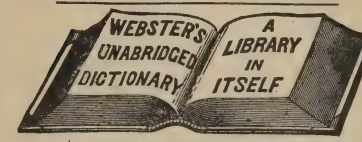
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A CHINESE COLUMBUS.

II.

In northern Mexico is a ruin which has been named *Casa Grande* by the Spaniards. It is, or rather was, a large structure (probably communal and related to the Zuni houses still existing in the south-west), built of adobe blocks and of considerable antiquity—at least the natives knew nothing of its origin at the time of the conquest. According to the latest and most reliable investigators the adobe blocks of which this structure is composed were not dried before being placed in the wall but were moulded *in situ* by the use of plank boxing. This is not the modern mode of building with adobe bricks; neither was it the Mesopotamian or Egyptian method. But it seems to have been the custom in Fusang to build houses in this manner. It must be confessed that this coincidence is rather singular as the Mexicans of Cortez' day built their adobe walls in the modern way and seem to have forgotten the art as practiced by the builders of the *Casa Grande.* *

It is true, also, that no walled cities existed in America (with the possible exception of Tuloom in Yucatan) prior to the discovery; but the inhabitants were not ignorant of fortification, as witness the defense of Tenochtitlan and the barrier of Tlascala (as well as numerous other examples), and they were not unskilled in the art of war. Indeed the Aztecs were far from being a peaceful

*In an article by Chas. H. Lepper in the Popular Science Monthly for November, entitled "Home life of the Thibetans," it is said that builders of houses in that Rome of Buddhism "much prefer to have only the foundations of stone and the walls above ground of well-prepared clay, which latter they build up between plank moulds. These are removed as each layer is finished, and then raised to act as moulds for the next layer."

people when the Spaniards came. But it may be urged that traditions were current in Mexico, and repeatedly rehearsed to the inquisitive *Conquistadores*, of the existence of an ancient nation, the Toltecs, who were the forerunners of the Aztecs in Anahuac and whose peaceful character and ignorance of military affairs had made them an easy prey to the savage valor of the later comers. Legend avers that when the Chichimces and Aztecs entered Anahuac they found it a land of happiness and peace, culture and piety, and that it was their sanguinary example which soon filled it with bloodshed and cruelty and obscene sacrificial rites.

As Fusang was named from the plant which gave its people so many of the necessities of life, so was it with Mexico. The ancient Aztec name for the Maguey was *Metl* and as compounds and derivatives in Aztec drop the *tl*, the word became *me; xiuitl* (*x* pronounced as *sh*) is the Aztec word for herb or plant, and, losing the *tl*, would become *xiui*, and later *xi; co* represents the same meaning as our word *in* with a locative signification—hence Mexico, the "Place of the Century Plant." This term was given to the land as a whole while the city was called *Tenochtitlan*, "The Prickly Pear upon a Stone."

The Mexicans certainly had "literary characters" which they used freely and intelligently and the material used for writing upon was for the most part the paper made from the Maguey fibre. The literature, large in quantity if the chroniclers can be believed, of the Aztecs perished in the flames which destroyed their idols, temples and palaces, and the few remnants that escaped are scattered throughout the civilized world.

The people of Fusang did not use iron, but made great use of copper in its place; it was precisely the same in Mexico. The two peoples were also alike in not making use of gold and silver as money. These precious metals were abundant, but were used only for ornamentation and in the arts. Cacaa beans, and other articles of merchandise, served as mediums of exchange in the Aztec markets.

The marriage customs of Fusang, as described by Hwui Shan, are not dissimilar to these customs as practiced among other primitive peoples. It is quite possible the Mexican of the Fifth Century thus wooed and won his bride, though no trace remains of the custom among the modern natives. The funeral customs of the two countries were, however, quite similar in many respects. The enforcement of criminal laws, and the character of the laws themselves, in Fusang, are remarkably like the jurisprudence of the Aztecs. In both, criminals of rank were tried by a council and buried in an excavation amidst ashes, and in both there was a distinction between the prisons north and south in respect to the character of the culprits confined in them. A resemblance is also apparent in the ascription given to the ruler. In Fu-

sang he his called "The Chief of Multitudes," and in Mexico "Chief of Men" and "Lord of the People."

This cursory presentation of Mr. Vining's argument must suffice: but it must not be supposed that it represents in any satisfactory degree the laborious, learned and really admirable presentation he makes of the subject. It has not been possible to show how completely he demolishes the criticisms of Klaproth, Neumann, Adam and others; how triumphantly he sustains de Guignes, d'Eichthal and their followers, by giving respectable proofs for what they could only show "in a glass darkly." It has not been shown with what industry he has ransacked the literary treasures of the world for proofs and illustrations, for critical capital and pertinent facts.

There remains, however, to outline the argument of Mr. Vining in support of the allegation that Buddhism found its way into America through the ministrations of the indefatigable missionaries of that noble and sacred faith. The spread of Gautama's tenets over the eastern world surpassed in rapidity of movement and number of converts every other religious faith; the more noteworthy from the fact that it was not propagated, like Christianity and Mahometanism, by the civil and military powers of governments. It was a gospel which lifted the lowest up to the highest, which robbed death of his sting and which taught a morality that needed neither reward or punishment for a spur. Actuated by the purest altruism, its monks carried from land to land, across deserts, and mountains and seas, in the midst of perils of all kinds, the gospel of the Lord Buddha to a fear-cursed world. To the north they penetrated into Siberia, to the east and south they sought the islands of the sea and westward they pushed as far as Greece and, perhaps, Scandinavia. Everywhere they carried the peculiar ceremonies and rituals which had grown up around the simple faith propagated by Guatami and wherever the faith was planted it took such strong root that no successive religious crusade has ever pushed it back one step.

It will be remembered by all who have read the pages of Prescott or Robertson, that there are traditions of the advent of several culture heroes in America. One of these, Quetzalcohuatl, the pure, the benevolent, the merciful, accompanied by a band of followers, appeared in Mexico ages ago and taught the natives their arts and sciences, and the doctrines of an elevated faith. He overthrew the altars and idols of the profane and superstitious, and instead of hecatombs, offered to heaven garlands of sweet flowers and the choicest gift of the harvest. He formed monastries, or religious houses for both sexes, which were still in existence, it was said, till Cortez swept them away, to make follow ground for his priests. The inhabitants of these houses lived very aus-

tere and ascetic lives. continence and penance were imposed upon them, and the chief business of their lives was to contemplate and worship the good, the beneficient Quetzalcohuatl. They were poorly clothed, wore their hair long, lived upon coarse and scanty fare and performed all sorts of work. At midnight they arose and bathed, then drew blood from their bodies and watched with chants and prayers till the early morning. For some devotees, even this austerity was not sufficient; such betook themselves to the woods and mountains to find the holy solitude they sought. The nuns were similar in many respects to the vestals of all other nations, as well as of the Buddists. The young monks, as described by Purchas, wore "their crowns shaven, as the friars in these parts." They "went into the citie foure or sixe together, to ask alms in all quarters, and, if they gote none, it was lawful for them to go into the cornefields." Of the several religious orders devoted to Quetzalcohuatl, the most renowned for sanctity, was Hamacazcayotl. The superior of this order lived in constant seclusion, no one being permitted to confer with him except the monarch. The lives of its members were very austere and laborious, and they were dressed in plain black robes.

Some of the priests were married, but the most of them followed the example of celibacy, set by Quetzalcohuatl. The members of all of these religious orders passed their time, when not occupied with penances and austerities, in writing the annals of the country, composing sermons and homilies, and educating the young. The parallelisms between the characteristics of Mexican priests and the bonzes of the Buddhist faith, hardly require pointing out. The devotees of Buddha of both sexes, spend their lives in vigils and penances. Their duties, education, and character are the same in all essential respects as those of Mexico.

"A belief in transmigration, firmly rooted and propagated in oriental countries, also existed in Mexico. In both regions it was the custom to adorn the temples with hangings of paper and in both a belief in enchantments and magic played a great role,"

It is in the sculptures of Palengne, however, that Buddhism seems to have left its most characteristic traces. The figure of Buddha is always represented as seated cross-legged on a couch, which is sometimes supported by two lions. Anyone who will take the trouble to examine Bancroft's "Native Races" or Short's volume, will find a very startling parallelism with Buddhist images in the cuts of Central American sculptures there presented. The oriental attitude, the similarity in the adjuncts and drapery, the incongruity of such figures with western art development, induce one to lend a ready credence to any theory which accounts for their existence without requiring a belief that they were the spontaneous creations of the American Indian.

It is by such arguments as these together with others of more or less pertinence, that Mr. Vining is led to believe that Hwui Shan and the five bhik'shus were Quetzalcohuatl and his followers; that they introduced the civilization of China and India, and taught the "Way" of Gautami; and that therefore the culture of the Mexicans and Central Americans was not indigenous, but the faint impression left, after centuries of vicissitudes, by the visit of Hwui Shan to America.

Now there is nothing incredible in the supposition that Asiatics visited the western continent in prehistoric times, or even that they found their way home again over the wide expanse of the Pacific. Such things might happen, like other accidents. But the difficulty in Mr. Vinings' case is, he proves too much. Not content with showing the probability of such a voyage (which is all that could be expected), he goes on to show by tradition, myth, religion and linguistics, as well as the tendency of art-forms, that the person named, at the time designated, did actually appear in Mexico, and exercise an immense influence in developing the latter progress.

The event thus sought to be dragged from oblivion happened 1,500 years ago, 1,000 years prior to the coming of Cortez. In that time what a shifting and changing has gone on in civilized Europe! The great Byzantine Empire has fallen and of its people not a soul can be distinguished among the races that now inhabit Turkey and Asia Minor. In Spain, France, Germany, Russia, Great Britain, new nations have arisen from squalid tribes and advanced to a stage of culture and influence beyond the conception of even Roman statesmanship. If such things could occur in countries that inherited all that Catholicism left of ancient moral and intellectual greatness, is it possible that the visit of a Buddhist bonze to the shores of America would work so great an influence on a few savage tribes as to be remembered for a thousand years? A century usually destroys the homogeneity of savage tribes. Wars, pestilence, migrations, famine all conspire to make combinations of savages ephemeral in their nature. Not less improbable is the survival of customs, religious or social, for such a length of time.

But there are other and stronger objections to Mr. Vining's theory. If a company of Budhist monks came to America as stated why did they not teach the aborigines the art of phonetic writing—the art so well known and so constantly practiced in India by all bonzes. Writing when once learned cannot be easily eradicated. A nation in possession of a system of writing like the Thibetan, or even the Malayan, must be utterly destroyed to destroy its knowledge of writing. Yet in America we find no graphic art that could not, and did not, take rise from the rudest pictography. There is not

a trace of an infusion of knowledge in this direction. Why, also, with an Asiatic culture, should the Americans have remained ignorant of the use of iron, of wheeled vehicles, of the horse, or some other beast of burden, of money and so many of the necessities and conveniences of life known to the Asiatics. Monks from Afghanistan should have known the pastoral arts and must have taught them to the Americans. If any of these arts had been carried to America by Buddhist bonzes their traces have been totally effaced, and a belief that customs, laws, religion, even language and race can survive the loss of these arts, when once acquired, is absurd.

The coincidences, remarkable as they may seem, can be explained on a principle now grown to be very familiar to investigators. The tendencies of widely different people are to advance on similar lines to reach definite ends. Samples of pottery dug up at Mycenae, at Troja, at Cyprus, in Greece, Egypt, Mesopotamia, India, Mexico, Peru, even from the mounds of the Mississippi Valley, cannot be distinguished from each other by the most expert scrutiny; and it is the same in the progress of customs and usages. In fact arguments drawn from such instances weigh very little now in determining race affinities; so that a mountain of such proofs would be of little effect in sustaining a theory which rests on nothing else.

Mr. Vining has undoubtedly said the utmost that can be advanced in support of his view. That his argument is not decesive of the question need hardly be stated. He has given, however, to literature one of those books whose genuine value lies in the mass of facts it presents, in a convenient, well digested shape. His book is well worth a perusal by the most sceptical, and, no doubt, many readers would dissent from the conclusions herein set forth.

HERBERT SPENCER'S ESSAY ON RELIGION.

II.

If the agnostics can harmonize their theory of evolution with the fact that theism was absolutely true and perfect in the very genesis of it, let them do so; but let them remember that the task devolved upon them is not to construct plausible theories concerning subsequent human degradations and anthropomorphisms of the primitive faith, but is to reconcile any *theory of evolution whatever, with the fact that primitive faith was a purer theism than any existing religion teaches*, and therefore, must have been a Divine Revelation.

While it is true that this faith was

the common property of all primitive races, it is also true that the Israelites alone preserved both the faith and the written statement of its origin, showing precisely what it was, and the process of the only development of it; and inasmuch as a great philosopher writes concerning 'the supernatural' as if he might be profoundly ignorant of the whole matter, it may be well to reproduce the facts presented by the original record, to demonstrate that these ideas of the supernatural did not "evolve out of ideas concerning the natural" but was revealed by God.

Some thirty-five centuries before the agnostics became so erudite and reputable as they now appear to be, Moses, the Monotheist, writing to and for his people who were all Unitarians, designated the one God in whom he and they beleived, by the name *Elohim*, which is the dual number of a Hebrew noun, and means two or a double God. He also represents the one God as applying to himself the pronouns *us* and *our*. "Let us make man in our image and our likeness." He also says that the two Gods, or the one dual God (*Elohim*) "created man in his own image; in the image of God, (the dual God) created he him, male and female created he them." The same solemn and mysterious declaration is afterward most emphatically reiterated. "This is the book of the generations of Adam. In the day that God created man, in the likeness of God made he him; male and female created he them; and blessed them, and called their name Adam, in the day when they were created."

Mr. Spencer is severe against anthropomorphism, but he must admit that Moses does not carry this natural fault so far as to declare that the "image and likeness" in which the human was created, subsisted in the form or bodily parts, or in the holiness or intelligence of man; but he expressly and repeatedly affirms that God created man in his own image *in this respect* that he created man, (the human), "male and female."

It is therefore too plain for argument, either that Moses believed that there were two Gods, (one male and one female) in whose image man was created, or else that the one God in whom Moses believed, was a Dual Being, self-existent, combining in one person both poles of spiritual sexhood, which faith we have seen to have been the common theism of all primitive races, and utterly antagonistic to the idea of evolution.

Moreover, Moses expressly informs us that up to a short time before the Exodus out of Egypt, the Israelites conceived God to be a Great Spirit, having about the same idea of Deity, that the red-men of America possessed, when the Europeans discovered this continent, and that the Dual God then revealed himself to Moses by the other essence of his dual nature, and assured him that he was not only God Almighty, *Elohim*, the Infinite Wisdom and Power, but

that he was also Jehovah, the Infinite Life and Love, and that this revelation was made in order to satisfy the doubting and complaining leader of the divine love for the chosen people. "I am Jehovah, and I appeared unto Abraham, and unto Isaac, and unto Jacob, as God Almighty, but by my name Jehovah, I was not known unto them." The account is given in full at Exodus V. and VI., and is curious and instructive, especially on the point that God was, according to Moses, one dual Spirit.

After God had created man (the human), he brought before man "every beast of the field, and every fowl of the air, to see what he would call them," in order that man might see that there was no creature that '*omoouusios*, consubstantial help-meet to man. Then God said; "It is not good that the man should be alone," (or one). Then he made a rib of the human into a woman, and distributed the dual human nature's female element into another form or person consubstantial '*omoouusios*, to the first form, and upon this identity of substance existing in different forms and persons was founded the institution of marriage. [Gen. 11, 23, 24.]

"Woman" and "Eve" were names given by the male to his help-meet; the very divine name was "Adam," "CALLED THEIR NAME ADAM, in the day when they were created."

The Talmudist say that human was created man-woman. Plato in his Symposium undertakes to account for amatory passion by which one man and one woman cleave unto each other of choice, by the declaration that the human was originally created androgynous, and that Zeus afterwards distributed the sexes into different forms of persons. Jesus Christ said that "Ye do err not knowing the scriptures" (*i. e.* of Moses) "for in heaven they neither marry nor are given in marriage; but are as the angels of God," meaning surely that our idea of sex is a physical differentiation, not essential to the human, except for the propagation of the species by natural generation in accordance with the Divine command, and that when we "shuffle off this mortal coil," that physical distinction ceases. And finally the physiologists inform us that up to a late period in gestation, the fœtal human has no sex.

The four Gospels tell us that Christ was 'begotten' of God, 'conceived' of the Holy Ghost, "in the beginning," before the creation; and the Fifth Gospel ('the Gospel of the Hebrews,' regarded by many critics as the original and authentic account) boldly and unreservedly states that the Holy Ghost (Jehovah) was the mother of Christ, ages before he was born of Mary; and the Christian church so taught and believed until Constantine subverted it, and established Ecclesiasticism upon the ruins of Christianity and Paganism, in order that he and other tyrants might rule over their fellow men "contrary to the scriptures."

Such was the Theism of Moses and

of the Prophets, and of the ante-Nicine church, taught from the very beginning; such was the Theism of all the primitive races before idolatry was known to mankind, a Theism certainly not less than forty centuries old; and an agnostic who can believe that "the ghost theory exhibits those steps quite clearly," by which these ideas concerning the supernatural evolve out of ideas concerning the natural," the first step being belief "in the fact that the other-self, supposed to wander in dreams, is believed to have actually done and seen whatever was dreamed," simply supplies us with a new illustration of the fact that the grossest intellectual errors are apt to follow the determination to apply physical laws to moral questions.

It is therefore simply to belie the facts if one say that "these ideas of the supernatural evolve out of ideas concerning the natural;" or if any one say that primitive faith was less perfect or less philosophical than it has since become "by the intellectual development which causes dissatisfaction with the crude interpretations previously accepted;" for the Theism of Moses is perfecter than that of Athanasius, and the theocracy of the law-givers was enlarged by the Prophets and perfected in Christ.

Mr. Spencer and the Agnostics are accustomed to speak condescendingly of the "Elohistic" and "Jehovistic" characteristics observable in the Pentateuch—is it true, then that these erudite gentlemen were ignorant of the *fact* that Moses in the fifth and fourth chapters of Exodus expressly states that prior to his own day the Divine being had appeared only as Elohim, but that He revealed himself to Moses as also Jehovah? "And Elohim spake unto Moses, and said unto him, I *am* Jehovah; and I appeared unto Abraham, and unto Isaac, and unto Jacob as Elohim, but by my name of Jehovah was I not known unto them".—Ex. vi. 2:3.

Not only does this article speak of comparatively modern nations among whom the primitive faith had long been overlaid by polytheism and idolatry, as if their "crude interpretations" were the original form of religion; but with a suavity that argues either dense and hopeless ignorance, or else finished and heartless duplicity, attributes to that true religion which God revealed to primitive man, and which was gradually developing from the days of Abraham all the monstrosities and abominations moral and intellectual which Constantine founded upon the ruins of the subverted Christianity.

"The cruelty of a Fejian god who, represented as devouring the souls of the dead, may be supposed to inflict torture during the process, is small compared with the cruelty of a god who condemns men to tortures that are eternal;" "the visiting on Adam's descendants through hundreds of generations dreadful penalties for a small transgression which they did not commit; the damning of all men who do not avail themselves of an

alleged mode of obtaining forgiveness, which most men have never heard of; and the affecting a reconciliation by sacrificing a son who was perfectly innocent, to satisfy the assumed necessity for a propitiatory victim; are modes of action which, ascribed to a human ruler, would call forth expressions of abhorrence."

Surely all these utterances are true! and it is also true that these worse than atheistic dogmas are the distinctive doctrines of Constantinism; but why refer to these horrible, *modern* ecclesiastical nightmares "in an account of the genesis of religion?"

Is not one guilty of a cruel libel upon Moses, and upon the Prophets, and upon John the Baptist, Matthew, Mark, Luke and John, and also upon Jesus Christ, when he ascribes these dogmas, or any one of them to the persons named, or any one of them? Moses never wrote one single sentence concerning "immortality," or "the life to come," or "a future state of rewards and punishments." No prophet makes the slightest reference to any such dogmas. John the Baptist preached all through Judea, and utterly failed to enunciate any such dogmas, and Jesus Christ Himself prescribed for His own disciples a form of prayer (the Paternoster) which contains not the least intimation of any such things as "immortality," "the life to come," or a "future state of rewards and punishments."

These dogmas were no part of the Revealed Religion, for "the Kingdom of Heaven" from the days of Adam down was the temporal government of God-Jehovah over the chosen people, in this world, and was not a "spiritual" religion, and had no refference to the world to come. The The only "salvation" contemplated in it was salvation from crime, hatred, violence, oppression, pauperism, in this world. It was the utter negation of human authority and the assertion of God's sole right to rule; and if a man will only dismiss all ecclesiastical "interpretations" from his mind, and carefully examine the Mosaic statutes concerning "The Lord's Release," "The Year of Jubilee," "slavery," "usury," and private property; he cannot fail to reach the conclusion that no state in Christtendom to-day possesses a social and political code so wisely devised to secure the common good, the public welfare, liberty, equality, and fraternity for all men, as was the code of Moses; nor can he fail to see that the prophecies foretold that under Christ these statutes were to be administered for all men, nor can he fail to discover that the very system of which the Israelitish kingdom was the antetype actually existed for about three centuries, and until Constantine subverted it.

He would beyond doubt leave such an examination with the conviction that every "account of the genesis of Religion" which fails to set forth the one indisputable fact that the Religion was, from the gen-

esis of it, a perfect system morally, socially and politically, and only became imperfect buman faithlessness and consequent degradation of the religious idea, is false in fact. He would percieve that those who speak of Jesus Christ as a " victim," and of visiting on Adam's descendants dreadful penalities for a small transgression which they did not commit," and of "damning all men who do not avail themselves of an alleged mode of obtaining forgiveness," *libel* the old Testament and the Gospel, and the Acts—and Moses and the Prophets, and Christ, for none of them ever taught or believed, any such things as these; they belong to Constantinism and not to Judaism, or to Christianity. He would perhaps discover it to be the direct, simple statement of a matter of fact to declare that mankind had in some way (which Moses symbolizes by his story of the eating of an apple in violation of the Divine command) fallen into a condition of conscious alienation from God, and all men were under conviction of sin, and that human endeavors to escape from this condition had filled the world with false religions from the dawn of time, and that the Son of God offered himself as the example of a mode of life by which man might become consciously at peace with God, by faith in him—a Divine "Enabling Act" suited to human incapacity. He might perhaps perceive that the Revealed Religion was divinely ordained to train men up to be fit for freedom in order that they might be holy; and *that apart from the Ceremonial Law*, the statutes ordained for the social and political regeneration of the Jews first, and of the Gentiles afterwards, were infinitely more wisely *adapted* to the accomplishment of that purpose than human legislation has ever been since to-wit; that the Laws of Moses were, and are unto this day, the best laws ever framed for any people; for while Christendom has borrowed from them, it has not improved them. He might finally feel a profound conviction that it is a sacred duty which every man of Mr. Spencer's ability, owed to his burdened fellow-man, to free himself from the strong and popular delusion that Constatine's ecclesiastical system which sanctifies the blasphemies of human authority, war, slavery, usury, and mammon worship, is the same Revealed Religion which from the days of Adam to those of the Nicene Council utterly repudiated all these infamies, and offered to mankind the only social and political system (based upon Faith)whereby it ever was, or ever will be, possible to banish crime, hatred, violence, pauperism and selfishness out of human life, and so regenerate the world; making, true Liberty and Religion possible for all men; and would see for himself that the Revealed Religion was never designed for anything but the temporal salvation of mankind, except in so far as it may be true that the spirit continues its own development in the

life to come, we know not under what conditions, nor to what end.

He would find that this system which was "Revealed," not "evolved," was imbedded in the law of Moses, and that the assertion of God's sole right to rule, the statutes against slavery and against usury, the statutes of the Lord, Release and the Jubilee (Lev. XXV.) were typical of it; that it was enlarged upon, and its full establishment foretold by the Prophets; that it was established by Jesus Christ, and continued for three centuries, and was rapidly regenerating the world when Constantine subverted it, and that the system of which the law was the type, the Prophecies the interpretation, and Primitive Christianity the fulfillment, was Faith plus Communism, the only True Democracy.

EVOLUTION IN THE ORCHARDS.

I have my family around me in my cottage, and we are a number of rather decided individualities, each one with peculiar features and tastes; but in my orchard there is a family of about the same age that is decidedly more positive and peculiar in its idiosyncrasies. The great rose family includes not only the rose and the briars, but the apples and the pears, and plums and cherries. Of these the apples and pears are generally associated in the orchard and are most closly related. Yet they must have come off from the parent stock at very different periods. I mean that the old rose ancestor had children that were apple-like and apple progenitors before it had pear-like children that were progenitors of the pear. The apple has certainly a much longer history than the pear, and has been much longer undergoing a civilizing process. You can see this in the fact that the pear reverts to thorn-producing very uniformly, while an apple is rarely found that has a trace of this primitive characteristic of the whole family. For at the outset not only rose-bushes were thorny, and blackberries and raspberries thorny, but apples, pears and all the rest of the cousins. The reason that some of them are not thorny to-day is that they have for a longer time been in possession of man, and not needing thorns have learned to leave them off. It is decidedly for the advantage of any bush or tree that has become an associate of man not to be thorny; for man is certain to reject the more thorny for the less thorny. While not objectionable to other fruit-eaters, thorns are very much in man's way. The result will be that in time such a characteristic will be eliminated from all fruits that are cultivated.

The raspberry has already made some moves in that direction till we have some excellent varieties that are nearly or quite thornless. If a

new variety shows itself among blackberries that has left off its terrible barbs it will be sure of survival as one of the fittest things in the garden. So we say the pear has not been with man as long as the apple has, because it has not learned to adapt itself so well to man's requirements.

This relative age of the pear and apple under civilization is also determined by the fragments found in the refuse heaps of the old Stone Age and the Swiss Lake dwellers. In their "kitchen middens" not more than a handful of fragments of pears have been found, while apples are discovered in abundance. As an ancient fruit it was a very small and almost worthless affair, and occupied but a limited area. Pliny and the poet Horace both refer to the pear, and Pliny says very explicitly that it could not be eaten unless cooked. So that historically the pear has a meager record, while the apple has a name in almost all languages, and is referred to by many writers as a notable fruit.

As true dessert fruits the pears date back only to the middle of the last century. The apple, on the contrary, is one of the oldest of eatable garden productions, dating back many hundreds of years, not only in Europe, but in a large part of Asia. It seems to have been brought into Europe by the earlier Aryans in a somewhat improved or selected state. At present we find in our orchards as a result of more recent selection a large number of special branches of the stock, varieties they cannot be called, as each group contains innumerable varieties, and those not species became established long before any pear was worthy of classification as a dessert fruit. The pippin got its blood so thoroughly fixed 200 years ago that its seedlings are distinguishable to-day all over the world. That is, in an orchard of seedlings, or in a wild thicket of apples, a good horticulturist is likely to find apples easily distinguished as descendants of the pippin line. They may be quite out of direct descent, and cross-bred to many degrees, yet by flavor, color, texture, shape, core, seeds, sutures, stem or otherwise, it is easy to determine the ancestry to be remotely pippin. Such family groups of pears we have, but very much less firmly established. When a variety of any fruit gets to be so positively traceable in descent we may be sure that it has been for a long while undergoing selective influences. Nothing is so hard to settle down to fixed idiosyncrasies as a sub-species. Break up a type and the tendency for a long while is toward infinite variation. Instability governs form or color or quality, or all these and other characteristics. I have over 200 cross-bred varieties of beans, which I have produced within four years. The trouble now is to fix the characteristics of any one of them, and stop the further propensity to crossing. The apple, however, has for a long while had what may be called horti-

cultural species, one of which I have referred to as the pippin; others are the bellefleur and gillifleur.

The apple has been so long man's companion and under the control of man that it has not only lost all recollection about thorns, but has been in many other ways civilized and refined. Now our word culture, as applied to people of a long line of educated generations, is a word borrowed from tree-growing and plant-growing. A tree is cultivated, that is, educated, by man's wisdom and skill. As a matter of fact, nature never quite forgets what she has once done. She likes to rehearse, just as we like to tell what we did when children. The frog never gets to be a frog until he has gone over his ancestral history as a tadpole. So the pear, if you sow the seed of a Sheldon, runs back to its ways of doing 10,000 years ago; only it may be that one seed in a hundred will tell the other story of progress. But the apple has very much less of this propensity to far backward looking. It is quite settled down to be content with civilization, and has even forgotten a good deal of what it once knew.

Now, we know that the great rose family, including pear, apple, quince, plum, almond, peach, apricot, rose, strawberry and blackberry, is peculiar in this, that it has developed a power to bribe insects and animals to do it some sort of service; for that really is what the strawberry and the apple and the other edible seeds are. They are temptations to induce the birds to eat them and so carry the seed about and sow them, and in that way enable them to spread and multiply. This bribing family never appeared on the earth until fruit-eating birds appeared—that is, the fruit-eating birds and the fruits for them to eat were created by evolution together. But, while it was a part of the business of these trees to get their fruits eaten, it was equally a part of their business not to get eaten themselves, therefore thorns were quite as necessary as nice apples and berries. The seeds evolved a power to swell out into receptacles of a pulp and juice agreeable to the birds, but they protected themselves against the browsing of animals as vigorously as they welcomed their feathered friends. The raspberry puffed out the whole ovary; the strawberry the seeds and ovary both. There was but one exception in the family to the thorn-producing. The strawberry or potentillas, nestling close to the ground, got a habit of running away from enemies and hiding, and so did not need to barb the noses of intruders.

And this went on after a simple sort for thousands of years. Strawberries, however, were but little more than dry seeds; and apples were only haws and other very insignificant things. But by and by man appeared on the scene, and though he at first had but little more taste than the other animals, he had just one thing more, a power to educate his taste. And as he educated his taste

he took the rose family out of the hands of nature and began to educate that too; just as he began to educate the wild beasts and make them tame ones. It was slow work, both with himself and with his pupils. All the steps we can't trace. But here we both are after 100,000 or 200,000 years and the result is quite satisfactory.

The bribe that the pear and apple offered at first to the birds and animals is largely withdrawn from them and offered now to man. They don't care whether animals like them or not, if they can only gratify our palates. I mean they don't much care, the really civilized members of the family do not. The apple, especially, has got quite used to catering for our markets. And the pear will after awhile get to be of the same mind. Of course there are a good many barbarous branches of the family, as there are savage tribes of men; and they will just be grafted, for it won't pay to work at them in the slower way of natural selection. Still once in a while the survival of the fittest gives us a Seckel pear right out of a wild tribe like Red Jacket or Scenondo among aborigines. So the apples, pears and berries of to-day are such as suit the palates of men and not of the birds.

But that is not all; they do not any longer have to protect themselves against being eaten up, and so they have stopped growing thorns. The apple tree has found out that it is safe enough without growing thorns. It is men's interest to protect it. And the pear after a few hundred years more, or may be less, will find out the same fact. A good many have already settled down to a thornless way of growing. Gradually everything takes into consideration man's habits and tastes and fits to them.

Will the roses shed their thorns also? Some of them, those longest in man's company, have already done so; but the tendency in some species or varieties to revert to thorns in seedlings is yet very marked. This will all be forgotten in time. And by and by our gardens will surely contain only varieties of berries that any lady can pick without being troubled with a survival of barbarous characteristics. The thorns will all be gone.

Now, I want you to observe the tendency of evolution in another way. It works in the same way with apples and pears and roses and men. I mean the tendency to individualize or concentrate its form, not on number, but on quality. This innovation came in when man was created, but it was passed over slowly to everything else that comes into man's closer association. Here is a wild-thorn apple growing beside a Northern Spy. In May they are equally profuse in bloom, because blossoms are for the eyes of insects as well as men; and the insects must be attracted to do an enormous amount of fertilizing, and take their pay in beauty and honey. But in June the flowers are all off. The Northern Spy forgets about the birds and thinks only of

man. So it throws away nine blossoms, and with the remaining one it goes to work at producing a great apple that shall be picked in October by man, and eaten by him, and so please him that he will protect that tree and graft it everywhere. On the other hand the wild apple does nothing of this sort. It does not know man nor consider him; it is a wild, untamed nature, and still thinks only of the birds. So for every blossom it produces a fruit, but every fruit is a little hard bitter affair that no man can eat. Here you see nature is making in the Spy the high-bred, costly individual, and this is what has lately been going on in our orchards. Just as in modern society the aim is to bring out superb men, instead of masses of human beings. But what of the wild haw or thorn apple? It has fallen under culture in another direction. Man does not care to educate its fruits, but he has found that he can educate its blossoms. Some haws and other thorns were found to vary slightly in color and size of flowers, and as man lives not only to eat but to see fine things, he has selected these to be preserved, and so we have now scarlet flowering and double flowering crabs and haws.

But all this while man himself has been a creature of evolution quite as much as the things he cultivates. His senses, and especially his taste has grown to be a very different affair from what it used to be. He will not eat now what a few generations ago was eaten with satisfaction. It would be hard to bribe a party of horticulturists to eat a Bon Critica pear, that fifty years ago was readily eaten by their fathers; or a belle pear, whose name indicates the opinion held about it. It is not unlikely that fifty years from now, that prince of good pears, the Sheldon, will be quite behind the cultured palates of our children. There are doubtless bad flavors in the Seckel and Anjou that you and I cannot discover, but which will some day be fully apparent to daintier tastes. Evolution is a purpose in nature that aims at better things all the time, and so it makes men as well as men's foods to improve.

Daintier birds as well as daintier men are the result, and always will be the result. And then daintier fruits will be needed, and whatever is needed will be sure to be supplied. And so it will go on, better men demanding better foods; better fruits demanding better men. The possibilities hidden in this grand rose family are almost as great as those hidden in man himself. The quince, which is also one of the same family, has a hint of some wonderful things that may not be brought out in long ages. The berries are marching on very rapidly. We shall have strawberries, in time, as large as eggs, and richer in flavor, than we could now appreciate if we had them. With daintier men come daintier birds. Robins are one of the more fastidious sorts that have grown up as a re-

sult of man's culture. He will on a pinch, eat a great many poor fruits, but he knows a good one when he can get it. He lives with us, not because he admires us, and our cats, and wicked boys, and ornithologists, and specimen hunters, but because he has a taste educated to the fruits he can only find in our vicinity. He is spoiled for wild life. Indeed the robin red-breast is purely a product of civilization, appearing only with man. And the cat-bird is being spoiled as fast as possible, for anything short of the finest cultivated raspberries and green peas. And we have several more birds on the same road. They can eat the old bitter berries when driven by hunger, but they have learned to know good fruits when they find them. The same is true, unfortunately, of some pestiferous insects.

So you see our apples and pears are members of a very curious family, and have a very interesting history, and a great future ahead of them. The two families that move along together, the very highest representatives of the culture of the vegetable kingdom and of the animal kingdom, are the rose family and the human family. Indeed, neither one could have become quite what it is but for the other. And if to-day the rose family should be obliterated I think it would go very hard with us to keep up our civilization.

THE KHETSHUA (Qquetchua) LANGUAGE.*

This publication of the renowned Swiss scientist and traveler, is summing up the results of a whole lifetime's assiduous studies upon *one* subject. To Tschudi's initiative and close observation, we are indebted for much of our scientific knowledge of the Peruvian people, language and antiquities, and for the last forty years his numerous publications on Peru are reckoned among the most thorough accounts on that distant and, in many respects, mysterious country. The main part of the volume before us is devoted to a free discussion of the grammatic peculiarities of Khetshua and its sister-dialects. Modern views and methods of treating grammatic subjects are adopted by the author; scientific precision is not coupled here with that dryness of style, which clings to the majority of books on grammar, and to linguistic treatises, and discourages so many readers from attacking the subject. Frequent comparisons with languages of other South American countries bestow peculiar attractiveness upon the subjects under treatment. The chapter on syntax is but short, for Khetshua, as well as many other synthetic languages, have syn-

*Von Tschudi, J. J., Organismus der Kletshua-Sprache. Leipzig, F. A. Brockhaus, 1884. 8 vo. XVI. and 534 pages.

tatic rules simple in the extreme; valuable additions to the volume are three long Khetshua texts with commentaries and an excursus upon the Chinchay-suyu dialect. The phonetics of the language are discussed at length, and the polemics of the author against other grammarians, especially Pacheco-Zegarro, fill many pages. The difficulty of the subject, which requires many other explanations besides, and the general importance of phonetics for the grammar of any language, sufficiently excuse these polemics. Pp. 92 *sqq.* embody a full bibliography of authors on the Peruvian dialects. The preface contains many statements of great interest and information of a startling and novel character. The historian, Garcilaso de la Vega, mentions a language spoken only by the Inca (members of the dynasty); it was considered divine, and the people were prohibited from acquiring it. But the eleven words which he mentions, and supposes to have been a part of the "Inca vocabulary," are either pure Khetshua terms or reducible to Khetshua radicals, and hence we fully approve Tschudi's opinion when he rejects the existence of the secret language altogether. What gave origin to Garcilaso's statement was probably the admixture of a few archaic words in the language used at court. The common language of Peru was first called *Khetshua* by the monk Domingo de S. Thomas, in his Dictionary of 1560, whereas the chroniclers before him called it, *lengua general del Peru; lengua cortesana; lengua del Cuzco; lengua del Inca.* The Khetshua *tribe* was one of many other tribes speaking that language, and during this century dwelt in the province called Andahuaylas; but why S. Thomas called the language by the name of *that* tribe, by which it is still named, is an unsolved problem, and the signification of the name is unknown.

The linguistic families of South America, are discussed pp. 26-30; 82 199, and a frank avowal is made of the enormous difficulty experienced in classifying them scientifically. The dialect of the Peruvian family, that is the sister-dialect of Khetshua, are sketched in detail (pp. 66-82), and the dialect commonly called Aimara relegated to another family of languages, the Kol'a. Ludovico Bertonio, an Italian Jesuit, wrote a grammar and a dictionary of that sonorous language, published respectively in 1603 and in 1612. This language is nothing else but the Lupaka dialect of the Kol'a stock, though introduced under the misnomer Aimara. Aimara was, says the chronicler Ramos, the name of one of the tribes, from which individuals were brought by the Inca Kapak Tupanki, to the shores of Lake Titicaca, and settled there as colonists; they spake a Khetshua dialect. Tschudi refutes every genealogic connection between Aimara, which is still spoken in Peru, and the Lupaka of Bertonio, although he states that the latter was largely influenced

by Khetshua, especially in its lexical elements.

Thousands of years before the Inca dynasty ruled the country, Khetshua was spoken in the same valleys where we find it spoken now; but which tribe or nation spoke it first? Contrary to the common opinion, that the Cuzco and Puno districts are the cradle of it, Von Tschudi's researches led him to assume, that the original Khetshua-speaking people came from the North, spread out for a while in the countries extending between the Andes and the Upper Amazon River, then slowly advanced toward the Huaraz, and finally reached the "lagune of Titikaka," where warlike tribes checked their futher advance. The dialects of Quito and Chinchaya, contain more archaic forms than those of the South, and hence the language probably originated in the North.

"Red men," the vulgar designation adopted for the Indians, is a mistranslation of the term *hombres colorados* of the earlier Spanish chroniclers. This term has to be rendered by *men of color*, *men showing color*, and not by *red men* or *redskins*, for the natural color of the Americans is rather brown than red or anything else. Von Tschudi states that in America the natives of countries showing the lowest medium temperature possess the darkest, of highest medium temperatures, the lightest complexions, *though there are exceptions to this law*, (a large number of exceptions, we think). The fact that every family of Indian tribes or languages possesses a distinct and different name for the Indian corn or *maize* leads him to the conclusion that this plant probably did not come from one original species, or travel from one original district to all the innumerable tribes of America. Maize is indigenous in America, but is nowhere found in its wild state at the present time, (p. 47, note). The difference in the aboriginal terms for maize does not prove much, we think; for when it was first imported into Europe, it came there under the only name of *maize*, (mahiz); now almost every European language has a different term for it. The momentous problem of the unity or plurality of creation-centres for *man* is mentioned by our author with the remark, that with the scientific facts now at our disposal we can not solve it, and that Darwinism, with its "entire apparatus of truth mixed with poetry" is just as powerless in that respect, although "in its well-known modesty" it has not been slow in giving its own solution.*

There is no uniform type for native skulls in America or elsewhere; complexion proves nothing for the original racial condition of a tribe, nor does community of customs,

*J. J. Von Tschudi evidently confounds Darwin with his followers, the evolutionists. The last mentioned blemish may be inherent to a few of the latter, but Darwin himself was a model of modesty.

habits or religion (pp. 8-10). Whether we subscribe to all the above opinions of Von Tschudi or not, his book will have one good effect; to set us thinking about anthropological questions in general and South American ethnography and linguistics in particular.

PROGRESS IN ELECTRIC RAILWAYS.

The latest periodicals are full of interesting descriptions and drawings of new appliances of electro-motive force to car locomotion. The following is a statement of the various attempts in this direction at different localities. The descriptions are condensed but retain the salient points in each system.

NEW YORK CITY.

One of the results of the meeting of representatives of the various electric railways in New York, last fall, has been the inauguration of the Daft System on Ninth Avenue, commencing at 14th street, in that city. A third rail has been laid on this line which is insulated by a patent device to prevent water from making connections from rail to sleeper in unfavorable weather. The steam-power consists of a large Wm. Wright engine with necessary accessories. Three fifty-horse Daft dynamos, of which two are in position, will generate the current, which is carried through the streets, upon poles, to the rails. The motor used in this experiment will be fourteen feet six inches long and six feet nine inches wide and will weigh nine tons. The principles of its applications may be briefly described as follows: The motor is mounted upon a truck, directly over the driving wheels, so that it turns on an axis at one end and may be lowered or raised at the other by a screw. The power is transmitted directly from the motor to the wheels by a grooved friction-gearing which consists simply of two parts, one keyed to the armature shaft, the other to the drive-wheel shaft. The pressure of the friction gearing is regulated by the screw which raises and lowers one end of the motor; this screw being useful also to raise the motor entirely away from its friction bearings. The supports of the motor are heavily cushioned with rubber as well as the trucks themselves. The connection with the middle rail, the conductor in this system, is by means of a heavy bronze wheel, fourteen inches in diameter, which may be raised or lowered at will. The contrivance for controlling the motor is placed at the outer end of the car, and consists of a sliding-contact device which raises or lowers the resistance in the field-magnet circuit. Of course this method diminishes, or increases, the speed of the motor by diminishing or increasing the amount of current.

There being also a cut-out in circuit, it is possible to run fast or slow, or to stop the car by this device alone, while it also possible to stop the car by the friction wheel. There is also an automatic signal device which warns the engineer of trouble on the road. The reversing gear is of the simplest character—four contact brushes which can be applied alternately in pairs. Ordinary hand-brakes will be used at present but some form of air or electricical apparatus will be used hereafter.

The Edison and Field companies have combined and are preparing to test their system on the Second Avenue line. Their steam-power is a 250 horse Whitehall & Smith engine, with accessories. On account of the high electro-motive force used (600 volts) the central rail (which conducts the current) must be carefully insulated. This is accomplished by supporting it on glass shoes protected by rubber strips from jars and vibrations. Since the commencement of their experiments these companies have changed their devices several times; but the latest is as follows: Each car is provided with a motor, thus being independent; and it is thought that by this means the strain from the traction required to move a heavy train will be evenly distributed. The motor is placed beneath the car floor on an extension of the truck. This removes the center of gravity of the car to a point near the driving-wheels, which are, of course, nearest the motor, and these must be depended upon for traction. The motor used is a compound-wound Siemans which gives 600 revolutions per minute by the use of an electro-motive force of 600 volts. The power is transmitted from the armature of the motor to a pulley, by means of a Weston friction-clutch, which is governed by an ordinary brake-wheel. From the pulley the power is taken to the driving wheels by a heavy leather belt. The tension of the belt may be varied by moving the motor back and forth or by means of an "idler," which also serves to give more bearing surface for the belt. Contact with the conductor is made by means of sliding brushes which are mounted on the ends of bars that keep them suspended when another road is crossed. The brushes are so arranged that they can turn, on reversing, and thus always drag: this gives a uniform current when passing joints etc. An extra pair of brushes, as in the Daft system, is used for reversing. Speed will be controlled by the friction brake, the motor running at a constant speed. The Eames vacuum brake will be used.

PHILADELPHIA.

Permission has been given the American Electric Railway Company to lay a conduit and experimental line on Ridge Avenue from the depot at Dauphin Street to Laurel Hill Cemetry. The work will begin in a few weeks. The company, says the *Electrical Review*, at first intended to lay its experimental

tracks in order to demonstrate the applicability of the electric motive power in Fairmount Park, and obtained authority to this effect from the Commissioners, but subsequently the decision was made to lay down a conduit and establish a plant in connection with an existing railway as a better means of demonstration to the public and those interested in electric railways.

Ridge avenue was chosen because of the peculiar grades, and in order to show the superiority of the new motor over horse-power in surmounting them in all weather.

The Electric Company will next week start work on its shop and engine-house. One car, provided with a motor, will be run at first, and this will not interfere with the trips of the regular horse-cars. The car will be one of the ordinary cars altered for the purpose, and will carry as many passengers as usual, the idea being to give the two motive powers a fair test, the claim being that the electrical is greatly the cheaper. The conduit will be laid so as to avoid interference with the travel of the horses, and the tracks will not be disturbed.

In shape the conduit will somewhat resemble those laid by the Traction Company, but will be of heavy timber, instead of iron, below ground. It will be braced inside with iron knees and provided with drainage facilities. Running along beneath the top will be the compound conductor of copper and iron, half circular in shape, well insulated and protected from damage from outside influences. On the top of the conduit forming each side of the slot, which will have a half inch opening, will be iron plates about five inches in diameter altogether. This slot opening will not be directly in the center of the track, but to one side of the meridian line.

The current will be transmitted by an ingenious contrivance from the conductor underground to the motor in the car, and will be under instant control of the driver or engineer. At intervals of eighteen feet plates will be arranged over the conduit, which may be readily removed for repairs and other work, and without removing the body of the conductor. The bottom of the conduit will be cemented previous to filling in the ground about it. A speed of seven to ten miles an hour is claimed for the experimental Ridge avenue line, and a saving of $2.50 to $3 per car over horse-power. The engineers are sanguine of the success of the electric street railway.

BALTIMORE.

"The various trials of the Daft electric motor on the Union Line Track, Baltimore," says the *Electrical Review*, "have been so successful that cars are now to be run regularly. Fifteen miles an hour was the rate of speed at a recent test. Considerable trouble has been caused by the contact of animals and human beings with the middle rail, which is

highly charged with electricity. On Monday, several Hampden boys experimented with the rail and were severely stunned. A horse belonging to N. A. Cornelius stepped on the rail at Mount Vernon switch and was so shocked and surprised that he kicked the harness and shaft all out of repair. Another horse attached to a cart loaded with stone was knocked down by contact with the rail and badly cut. A horse belonging to W. H. Ortloff, a butcher, suffered the same fate, and, in expressing his feelings, he wrecked the harness. A flock of geese perched upon the electrified rail at Hampden Hall; they were knocked in all directions; one was hurled five feet in the air. A dog who witnessed the unusual commotion among the feathered bipeds, went to investigate the matter. As soon as he touched the rail he turned a double-somersault, and picking himself up, went off yelping. Notices have been posted along the track warning people to keep off the central rail."

It was upon the Union Railway that the recent experiment with the Bauer storage cells, noted in the August REVIEW, was made. From later information it appears that forty-nine cells were placed on the car, of which but twenty-nine were used on level ground and thirty-nine or forty-nine afterwards connected as the grade required. Eighteen persons were in the car, which, with the weight of the car, motor, etc., made a total of five and one-half tons. The car moved out of the yard, passing over grades of 235 feet to the mile, and around curves of 75 feet radius, with ease and comfort. The batteries of one-fourth horse-power each, were made for incandescent lighting but seemed to answer the purpose admirably. The loaded car made six miles per hour on level ground. The total value of the 49 cells used was 8.6 horse-power.

CLEVELAND, OHIO.

Since August last year the East Cleveland Horse Railway Co. has substituted electricity for horses as a motive power, and, notwithstanding the most trying ordeals, the experiment has been successful. In this system the electric conductor is placed in a conduit which runs between the rails. This conduit is slotted throughout its length and a conductor from the car is thus enabled to gather up the electric force. The conduit is kept clean automatically and provision is made for removing snow from the tracks.

DENVER.

In Denver, experiments of a thorough and costly nature are being made, to determine the best system for use on the line already constructed by a company of capitalists. Prof. Thompson, the electrician of the company, has not determined upon the system to be employed as yet.

CANADA.

The Vandepoele Company of Chi-

cago, whose motors and generators are used on the Kansas City line, has secured a contract for building an electrical railway at Toronto, Ont., to carry the passengers to the coming Industrial Exposition there. The railway which the Vandepoele Company had there last year, an experimental one, is said to have been a perfect success, and to have carried 200 passengers to each train. The present railway will be extended to the city railways, and it is to become a permanent institution,

GREAT BRITAIN.

Probably the first Electric railway constructed in Great Britain, was the one running from Port Rush to Bushnells, near the Giants Causeway, in the north of Ireland. This system derives its power through the rails, and, while expensive and crude is very interesting, and, it is said, pays good dividends on the investment.

Several tramways, as the English call them, are either in operation or in process of construction in England. Among them may be mentioned the Blackpool Electric Tramway, lately completed. One of the cars built for this road, now running at the Inventions Exposition, has carried as many as 2,200 passengers in one day. Unfortunately the Board of trade has refused to allow the road to be opened, on account of faulty construction.

Another venture in this line is the Bessbrook and Newry Electric Tramway, on which the recent accidents occurred during an experimental trip. The accident was almost a duplicate of the cable-road accident on the inclined plane, in Kansas City; the brake apparatus did not work and the car shot down a grade with tremendous speed. The electric power had been cut off and hence the motors could not be reversed.

The *Telegraphic Journal and Electrical Review* (English) describes a new electrical locomotive as follows: "We understand that there is at present in the works of the North Metropolitan Tramway Company, an electrical locomotive intended for use upon that company's line. This engine has been running on a private line for several week's, and, so far, satisfactorily. The locomotive is ten feet long by six feet wide, and externally is very much like the steam locomotives at Stamford Hill. The system adopted is that of using accumulators as the motive power, and the laminated armature of the motor is of Walker's construction, having eight divisions and 31 coils. With a current of 38 Amperes, and at 800 revolutions per minute, the motor develoopes 32 horse power, its weight being 287 pounds."

It is rather difficult to determine what it is that weighs 287 pounds. A motor of that weight would scarcely give that much power, and the accumulators necessary to produce the power, would certainly weigh more than 287 pounds.

In the system just noted the gear-

ing is upon Elieson's lever-transmission patent. The motor revolves upon an axle which communicates motion to the driving wheels through a set of differential mitre wheels, the speed ratio bing 1 to 8.5. The reversing motion is accomplished by means of clutches upon these wheels, the motor revolving always in the same direction.

The Reckenzaun system, wherein the electric force is supplied from accumulators, may be briefly described as follows: There are two motors driving each car, of nine horse power each, and each weighing 420 pounds. Each motor rests upon a bogie, one axle of which is a driving axle, both bogies thus giving four small driving wheels. The necessarily high speed of the motors is reduced by means of a worm on each motor-shaft and worm wheels on the driving axles, which gives a ratio of about 1 to 12. Speed and power are varied by means of a compound switch which arranges the motor circuits, so that the machines shall work in series. The driver uses one hand for all the operations of starting, stopping and varying the speed or power. There are two brakes, one the old form the other electrical.

THE CONTINENT.

The Siemans Electric Railway, constructed in the suburbs of Berlin, is one of the most successful and satisfactory thus far constructed. In this system the conductor is a hollow tube erected on posts beside the track. This tube has a continuous slit in its under surface through which brushes are introduced and dragged along to gather up the electrical energy. Wires are attached to the brushes, and conduct the power to a motor in connection with the shaft of the driving wheels.

This system is similar to that of Mr. J. C. Henry, of Kansas City, insofar as the conductor is carried on supports along the track. But the sliding contact of the brushes causes "sparking" and consequent deterioration and waste in the conductors as well as the brushes. Mr. Henry's device is a rolling contact which does not cause "sparking."

The *Electrical Review* (N. Y.,) calls attention to an excellent example of an important electrical mineral line. "This line is now in operation at the Paulus-Hohenzollern Collieries in Upper Siliesia. The line, which is 800 yards in length, has been constructed for a traffic of 400 tons of coal in ten hours. This result Messrs. Siemens and Halske have guaranteed. The electrical locomotive weighs two tons; it is controlled by a specially devised regulator, which is said to give great satisfaction to those in charge of the train, by its prompt and certain action. The insulated conductor consists of flat iron bars, galvanized at the ends and connected by means of fish plates. This conductor is suspended from the roof upon insulators. Brushes on the locomotives take the current from the conductor.

The line is connected with the generator by cables about 250 yards long. The generator is driven by a belt from the flywheel of an engine. The trucks weigh 10 cwt. each, and have a capacity of 11 cwt. The train is composed of fifteen trucks, so that the useful load hauled is a little over eight tons, and the whole load nearly sixteen tons. With this load a speed of seven and a half feet per second is reached. With an empty train the speed is 12 feet a second. At present the output is not sufficient to require the maximum transport of five hundred tons a day."

There are several lines in operation or projected in and about Paris. Probably the most useful of these is the one which has been in operation for several years, to the bleach-fields of *Breuil en Auge.* It transports the linen to the grounds with a cleanliness that could not be expected if steam were used. In this system 60 Faure accumulators, carried in the tender of the train, provide the electro-motive force.

In conclusion it is hardly possible to predict the extent and importance of the uses to which electro-mtoive force may be hereafter applied.

No one who is informed on the subject will maintain that there is a doubt of its successful application to motor purposes on street railways.

PRE-HISTORIC AMERICA.*

This is a companion volume to its learned author's "Les Tremiers Hommes et les Temps Pre-historiques," which dealt with the Stone Age in Europe. There is no lack of treatises in both English and Continental languages on this latter subject, and the expositor has the easy task of treading in well-worn footsteps. The uniform character of the relics of Palæolithic man, unearthed in thousands from river-gravels and bone caverns, has left little play for archæological vagaries or few speculative fancies concerning their makers. But it is otherwise with the pre historic races and those often stupendous relics of the New World which have long been looked at through the magnifying and tinted glasses of the romancer and the sciolist, and have been invested with the glamour and mystery in which ignorance covers its nakedness.

"Among the crude and imperfectly-digested hypotheses which have engaged the attention of untrained ethnologists, none have been more popular than those which ascribed the origin of the Americans to full-fledged races, such as we know at present in other regions of the world. Among those who have been claimed as the original or genuine ancestors of the Americans are the Chinese, the Japanese, the Ma-

*From Knowledge for July.

lays, the Egyptians, the Phoenicians, the Basues, the ten lost tribes of Israel, the early Irish, the Welsh, the Norsemen, some unknown Asiatic Freemasons, and other equally unknown Buddhists. Volumes have been filled with the most enthusiastic rubbish by men upon whose ability and sanity in other matters, nothing has ever thrown a "doubt. Fortunately the era of such speculations is passing away. The scientific treatment of anthropological subjects is no longer the exception."

"The "ten lost tribes" still linger with us, and doubtless will continue to do so for some time, probably becoming in their turn the subject of investigation by psychologists interested in aberrant mental phenomena. But every day increases our knowledge of the true constitution of savage society, and builds a more enduring barrier against the floods of pure hypothesis."

The foregoing extract is a guarantee that we have in the present work a sober contribution to a subject which, under the treatment it now receives, falls into its relative place in the general science of human culture. M. de Nadaillac's volume covers more ground than the title indicates, the larger part of it, and that necessarily the most copiously illustrated, having more interest for the antiquarian than for the anthropologist; but in the earlier and latter chapters, as well as in references to cosmogonic legends and practices scattered throughout the work, the anthropologist will find enough and to spare of interesting and suggestive matter.

In all that the author and his American editor (from whose revision the book has largely gained) have to say concerning the co-existence of man with mammals now extinct, concerning the character of his earliest known relics and the deposits in which they occur, concerning his place in the geological record, the reader will be struck with the parallelisms between pre-historic peoples of the Old World and the New, with the proofs of the strictly analogous phases of culture through man has everywhere passed in his ascent from savagery, and with the absence of any essential physical difference between races, their unity, as the author remarks, "standing out as the great law dominating the history of mankind." Of course they did everything on the biggest scale in America from the earliest times. The kitchen middeus, or refuse and offal heaps which are scattered along the shores of the Baltic, although of considerable size, are very "small pumpkins" to the like shell heaps and samboquis along the Atlantic and Pacific coasts, some of which cover many acres and reach a height of forty or fifty feet; the more remarkable mounds, to be referred to presently, are, compared to the tumuli of the Old World, as the Himalayas to the Mendip Hills; the pyramids challenge comparison with the famous pyramid of Cheops;

the palaces vie with the classic ruins of the Palatine; and the megalithic remains would enclose a mightier ruin than the broken circle of our Stonehenge. In the summary of evidence concerning man's antiquity in America, the cautious spirit in which the author approaches the problem is apparent, He has not listened to the charming of the French Savans, who find human relics in the middle tertiaries in Europe. Although agreeing that man lived before the glacial epoch in North America, he recognizes the difficulty of fixing the precise time of his appearance, and in the uncertainty which attaches to the exact deposits in which certain relics of him—notably the Calaveras skull—occur, wisely leaves the question open. But the main interest of the volume gathers round the exhaustive account which the author gives of the thousands of artificial mounds in the great river valleys south of the Rocky Mountains, and along the Gulf of Mexico, through the length of the Southern Continent. They appear to have little or no relation to the burial mounds scattered over Europe and Asia, and which are referred to pre-Aryan tomb-raising peoples, being unlike in their fantastic shapes, and apparently intended for defensive and sacrificial, as well as sepulchral purposes. Many of them are of geometrical form, oval, square, round, more rarely, polygonal or triangular, either rising from hill summits, or standsolitary on plains, or enclosed within earth-walls. In some parts of the far West, the mounds represent mammals, birds and reptiles; indeed, some bold architects have not hesitated to attempt to imitate the human body. In Wisconsin "they represent men with the trunk, head, arms, and legs still recognizable; mammals sixty-five yards long; birds with outspread wings measuring more than thirty-two yards from tip to tip; reptiles of colosal dimensions, and, lastly, Pigeon mentions having seen in Minnesota a huge spider, whose body and legs covered an acre of ground." The cyclopean character and varied forms of these mounds led superficial inquirers to attribute them to some mysterious race of "giants in those days" which has completely disappeared, and with which the extant Indians of the Americas have no affinity. That the works are of a vast and undetermined antiquity is unquestioned, for as with the rough measurement of the deposition of remains beneath the successive layers of trees in the Danish peatbogs, the lapse of a long period is evidenced by the generations of varieties of trees which cover the mounds. And it, as M. de Nadaillac points out, we look among existing tribes for the lineal descendants of the Mound Builders, we may look in vain, since the richest, the most cultured, and the most sedentary of the Indians existing when the white race poured into America like a resistless flood, have been destroyed; of many tribes none remain,

of others, only a feeble remnant, which has readily adopted the methods and art of the dominant race. Nevertheless, the conclusion at which the author in agreement with the leading authorities, arrives, is that expressed by Dr. Brinton as follows: —"All these earthworks—and I am inclined to assert the same of the whole of those in the Atlantic States, and the majority of the Mississippi Valley—were the production, not of some mythical tribe of high civilization in remote antiquity, but of the identical nations found by the whites residing in those regions." To which may be added the opinion of Schoolcraft. "There is nothing indeed in the magnitude and structure of our western mounds, which a semi-hunter and semi-agricultural population like that which may be ascribed to the ancesters of Indian predecessors of the existing race, could not have executed." The state of relatively high culture which these races, while still in the Bronze Age, had reached, is described in a profusely-illustrated chapter on their tools and weapons, and to this succeeds a striking account of the ruined bee-hive-like pueblos or communal villages built in valleys once fertile, but now barren and deserted, or on cliffs accessible only by ladders or by steps cut in their sheer sides.

Such sites were obviously chosen, like those of the lake dwellers in Central Europe in the past, and in New Guinea and Central Africa today, for security against fierce and dangerous enemies. But, an enemy more irresistible than these—diminished rainfall through destruction of forests, and censequent barreness—effected the decay of these energetic dwellers in the rocks.

The ruins ot Central America and Peru; temples—scenes of revolting rites—and palaces obscured in the densest vegetation, statutes, idols, bas-reliefs, rock paintings and sculptures, the grotesqueness of the art unredeemed by any feeling of the beautiful, Nature alone festooning them with her wild loveliness; the rise of the famous dynasties, Aztecs and Incas, are the subject of copiously-illustrated chapters, which narrate in easy flowing style the story of these ancient civilizations. In the final chapter, which is mainly the work of the American editor, the origin of man in the New World is discussed, and the conclusion deduced from the general laws of geographical distribution and from the physical characteristics of the several races, is that he is not anthochthonous.

A Copious index completes the usefulness of a book which is indispensable to the anthropologist.

NATIVE AMERICAN DOGS.*

The impression that the domestic dog of the old world has descended

*From the American Naturalist for September.

from wild species distinct from the wolf may be well founded, but in America the evidence tends to prove that the Eskimo, and other domestic varieties of dogs were domesticated by the aborigines and used by them long anterior to the discovery of the continent by the Europeans, the varieties in question originating from the gray wolf or prairie wolf. First as to the Eskimo dog. From the following extract from Frobisher it appears evident that the Eskimo had the present breed of domestic dogs long anterior to the year 1577. Frobisher's account of the Eskimo themselves is, so far as we know, the first extant, and is full and characteristic. After describing the natives he goes on to say: "They frank or keepe certaine dogs not much unlike wolves, which they yoke together, as we do oxen and horses, to a sled or traile; and so carry their necessaries over the yce and snow from place to place; as the captive, whom we have, made perfect signes. And when those dogs are not apt for the same use, or when with hunger they are constrained for lack of other vituals, they eate them, so that they are as needful for them in respect of their bignesse as our oxen are for us."

Regarding the Eskimo dog, Richardson remarks in his Fauna Boreali-Americana, p. 75: "The great resemblance which the domestic dogs of the aboriginal tribes of America bear to the wolves of the same country was remarked by the earliest settlers from Europe (Smith's Virginia), and has induced some naturalists of much observation to consider them to be merely half tamed wolves (Kalm). Without entering at all into the question of the origin of the domestic dog, I may state that the resemblance between the wolves and the dogs of those Indian nations, who still preserve their ancient mode of life, continues to be very remarkable, and it is nowhere more so, than at the very northern extremity of the continent, the Esquimaux dogs being not only extremely like the gray wolves of the Arctic circle, in form and color, but also nearly equaling them in size. The dog has generally a shorter tail than the wolf and carries it more frequently curled over the hip, but the latter practice is not totally unknown to the wolf. * * * I have, however, seen a family of wolves playing together, occasionally carry their tail curled upwards."

The Hare Indian dog is also supposed to be a domesticated race of the prairie dog, as shown by the following extract from Richardson's Fauna Boreali-Americana, "*Canis familiaris* var. *B lagopus*. Hare Indian dog. This variety of dog is cultivated at present, so far as I know, only by the Hare Indians and other tribes that frequent the border of Great Bear Lake and the banks of the Mackenzie. It is used by them solely in the chase, being too small to be useful as a beast of burden or draught." It is smaller than the prairie wolf. "On comparing live

specimens I could detect no marked difference in form (except the smallness of its cranium), nor in fineness of the fur, and arrangement of its spots of color. * * * It, in fact, bears the same relation to the prairie wolf that the Esquimaux dog does to the great gray wolf."

Another variety of Indian dog is Richardson's *canis familiaris* var. *D novæcaledoniæ*, Carrier Indian dog. The Attnah or Carrier Indians of New Caledonia possess a variety of dog which differs from the other northern races. "It was the size of a large turnspit dog and had somewhat of the same form of body; but it had straight legs, and its erect ears gave it a different physiognomy."

The spitz dog, Mr. J. A. Allen informs us, is with little doubt a domesticated subarctic variety of the prairie wolf.

Sir John Richardson in the Appendix to Bock's Narrative, Paris, 1836, p. 256, remarks: "Indeed, the wolves and the domestic dogs of the fur countries are so like each other, that it is not easy to distinguish them at a small distance; the want of strength and courage of the former being the principal difference. The offspring of the wolf and Indian dog are prolific, and are prized by the voyagers as beasts of draught, being stronger than the ordinary dog."

The origin of the ordinary Indian dog of North America is obscure, but Richardson, who names it *Canis familiaris* var. *C canadensis*, North American dog, throws much light on its origin:

"By the above title I wish to designate the kind of dog which is most generally cultivated by the native tribes of Canada, and the Hudson Bay countries. It is intermediate in size and form between the two preceeding varieties, and by those who consider the domestic races of dogs to be derived from wild animals, this might be termed the offspring of a cross between the prairie and gray wolves. * * * The fur of the North American dog is similar to that of the Esquimaux breed, and of the wolves. The prevailing colors are black and gray, mixed with white. Some of them are entirely black. * * *"

He quotes from Theodato "Canada," written in 1630, to show that at that early period, and "perhaps even before the arrival of Europeans, they formed an esteemed article of food of the natives." Confirmatory of the theory of the Pre-columbian origin of the Indian dog, may be cited the following extract from Hakluyt's voyages regarding the Indian dogs seen on Cape Breton island, p. 1593:

"Here divers of our men went on land upon the very cape, where, at their arrival they found the spittes of Oke of the savages which had roasted meate a little before. And as they viewed the country they sawe divers beastes and foules, as blacke foxes, deere, otters, great foules with red legges, pengwyns, and certain others. * * * There-upon nine or tenne of his fellows running right up over

the bushes with great agilitie and swiftness came toward us with white staves in their hands like halfe pikes, and their dogges of colour black not so bigge as a greyhounde followed them at the heeles; but we retired into our boate without any hurt at all received." (The voyage of the ship called the *Marigold* of M. Hill of Redrise unto Cape Breton and beyond to the latitude of 44 degrees and an half, 1593, written by Richard Fisher Master Hilles man of Redriffe, Hakluyt, III, 239).

It is probably this variety, the bones of which have been found by Dr. J. Wyman, in the shell heaps of Casco Bay, Maine. The presence of the bones of the *dog* might be accounted for on the score of its being a domesticated animal, but the fact that they were not only found mingled with those of the edible kinds, but like them were broken up, suggests the probability of their having been used as food. We have not seen it mentioned, however, by any of the earlier writers, that such was the case along the coast, though it appears to have been otherwise with regard to some of the interior tribes, as the Hurons. With them game being scarce, "venison was a luxury found only at feasts, and dog flesh was in high esteem."* * * A whole left half of the lower jaw of a *wolf* was found at Mount Desert, measuring 7.5 inches in length, making a strong contrast in size, with a similar half from a dog found at Crouch's cave. This was more curved, and had a length of a little less than five inches (Amer. Nat. I, 576, Jan. 1868). It is possible that the Newfoundland dog was indigenous on that island, and also an offshoot of the gray wolf, allied to the Eskimo. In their "Newfoundland" Messrs. Hatton and Harvey say that there are few fine specimens of the world-renowned "Newfoundland dog" to be met with now on the island, from which it derives its name. "The origin of this fine breed is lost in obscurity. It is doubtful whether the aboriginees possessed the dog at all; and it is highly improbable that the Newfoundland dog is indigenous. Some happy crossing of breeds may have produced it here. The old settlers say that the ancient genuine breed consisted of a dog twenty-six inches high, with black ticked body, gray muzzle, and gray or white stockinged legs, with deer claws behind." Judicious treatment has greatly improved the breed. "Their color is white, with black patches, curly coats, noble heads and powerful frames. The favorite Newfoundland dog at present, is entirely black, of large size, from twenty-six to thirty inches in height, remarkable for his majestic appearance. It is now generally admitted that there are two distinct types of the Newfoundland dog, one considerably larger than the other, and reckoned as the true breed; the other being named the Labrador or St. John's, or Lesser Newfoundland. The latter is chiefly found in Labrador, and specimens are also to

be met with in Newfoundland," pp. 194-195.

Regarding the dogs of the Mexican Indians, Nadaillac says in his Prehistoric America: "The European dog, our faithful companion, also appears to have been a stranger to them. His place is very inadequately filled by the coyote, or prairie wolf, which they kept in captivity and had succeeded in taming to a certain extent."

In a recent visit to Mexico, not only along the railroads, but in the course of a stage ride of about five hundred miles, through provincial Mexico, from Saltillo to Don Miguel, we were struck by the resemblance of the dogs to the coyotes; there can be little doubt but they are the desendants of a race which sprang from the partly tamed coyote of the ancient Mexican Indians. At one village, Montezuma, we saw a hairless or Carib dog as we supposed it to be; similar dogs are sometimes seen in the United States.

Finally that the domestic dog and gray as well as the prairie wolf, will hybridize has been well established.*

DICKENS AND THACKERAY.

[From Knowledge, June, 1885.]

Mr. Thurlow Weed, the American politician, once expressed surprise at the circumstance that in England Dickens does not seem to be at present held in such high esteem as in America. He remarked that, to him, there seemed no comparison between Thackeray and Dickens, so far at least as their power of enchaining the attention was concerned. I propose to point out some considerations which appear to me to justify the opinion which is now generally entertained in England respecting Dickens' writings. It also should, however, be understood that those who recognize most clearly the shortcomings of Dickens even as a humor-

*Dr. Cones has observed hybrids between the coyote and domestic dog on the upper Missouri (see the American Naturalist. 1873, p. 385). To this we may add our own observations made at Fort Clagget on the Upper Missouri in June 1877. We then were much struck by the wolf-like appearance of the dogs about an encampment of Crow Indians, as well as the fort; they were of the size and color of the coyote, but less hairy and with a less bushy tail. They were much like those lately observed in Mexico, and I have never seen such dogs elsewhere. Their color was a whitish tawny, like that of the Eskimo dog.

Confirmatory of these observations is the following note by J. L. Wortman, in the report of the Geological Survey of Indiana for 1884: "During extended travel in Western U. S. my experience has been the same as that recorded by Dr. Cones. It is by no means uncommon to find mongrel dogs among many of the Western tribes, notably among Umatillas, Bannocks, Shoshones, Arrapahoes, Crows, Sioux, which to one familiar with the color, physiognomy and habits of the coyote, have every appearance of blood relationship, if not, in many cases, this animal itself in a state of semi-domestication. The free inter-breeding of these animals, with a perfectly fertile product, has been so often repeated to me by thoroughly reliable authorities and whose opportunities for observation were ample, that I feel perfectly willing to accept Dr. Cones statement."

To these statements may be added that of Milton P. Pierce. published in Forest and Stream for June 25, 1885, as follows: Hybrid wolves have always been very common along our Western frontier. I have seen several of them, sired both by dogs and wolves, and all I have seen have resembled wolves rather than dogs." It is to be hoped that our mammalogists may collect and examine this subject, particularly the skulls and skins of numerous specimens both of dogs and wolves and of the hybrids betweed them. Further observations are also needed as to the fertility of the hybrids.

ist (using this word in the wide sense in which Thackeray has employed it in his lectures on writers of the last century), feel too deeply the debt of gratitude the world owes to Dickens, to desire in any way to be-little a name which men will always hold in high esteem.

It may be convenient, though there are objections to such a course, to follow Mr. Thurlow Weed in making comparisons between Dickens and Thackeray. It will be noticed that though he says there is no comparison he, in that very remark, makes very definite comparison between the two writers. The practice of instituting such comparisons is not a pleasing one. We may praise, or, if occasion arise, blame, a writer, a painter, a sculptor or a man of science, without inquiring whether he deserves more or less praise or blame than some other worker in his own line. I have noted cases where comparisons, unnecessarily introduced into criticisms, seem as though specially intended, as certainly they are calculated, to excite ill-will between the persons compared; and it would be well if a system of criticism were adopted from which all such comparisons should be rigidly excluded as michievous and offensive. But in considering the work of two such writers as Dickens and Thackeray comparison can hardly be avoided, though often the study of their writings suggests rather contrast than comparison.

So far as the construction of their stories are concerned, neither Dickens nor Thackeray has shown special skill. But there is one marked difference between them in this respect: Thackeray deliberately rejected the old fashioned method of constructing a plot. His stories are pictures from real life, and were meant to be such. He no more attempts artistic arrangement than Hogarth aimed at color effects in his paintings. In fact, at times, when he finds his events moving towards an effective situation, Thackeray deliberately interrupts the current of his narrative to call attention to the opportunity thus offered for fine writing, of which, however, he refuses to avail himself. I could cite several instances, but will content myself by mentioning the scene where Philip Firmin breaks in upon a group of angry persons on Mme. Smolensk's staircase. "Here, I protest," he says, or to that effect —"here, I protest, is a fine situation," and he proceeds to sketch in the details; but in order rather to make a grotesque than an effective situation—though there are few passages more beautiful than the closing lines of that description.[1]

1. On this point Mr. Proctor differs from many competent critics. It has been generally supposed that Dickens took more liberties with the traditional form of English fiction than Thackeray. Without reference to the fact, remarked by M. Taine, that neither of these Masters ventured to shock public opinion by portraying the passion of love in an unconventional manner, it may be asserted confidently, that Thackeray's genius and education led him to accept the literary heritage left by preceding English novelists, much more fully than his great congener. It is true, as noted by one of his critics, that his novels have the misfortune of recalling those of Miss Edgeworth; and it is none the less true that De Foe and Swift sometimes more than whisper

With Dickens the case is altogether different. It is true that "Pickwick" was purposely written without any definite plot; but Dickens was then writing to order. In all his other stories he manifestly aimed at the construction of an attractive plot, after the old fashioned manner, the story to come to a close with the marriage of the hero and heroine, the good characters to get their proper reward, the villains to be duly punished.[2] He not only failed, but it is noteworthy that not one of his heroes or heroines, and scarcely one of his very good and very villainous characters is well painted. His heroes, indeed, are, for the most part, like that youth of the Chuzzlewit family, who had no outline, or rather they may be described as Mantalini described two of his imaginary conquests, of whom one "had no outline at all," and the other "had a demned outline." Clennam and Walter Gay are of the no outline sort; Nickleby, Harmon and Chuzzlewit belong to the other category.[3]

It is in fact in the presentation of character that the contrast between Thackeray and Dickens is most marked. It appears to me that Thackeray stands among the very first of our English writers in this respect, even if, so far as novel writing is concerned, he is not absolutely first. Macaulay would have set Jane Austen before Thackeray, because of the skill with which she delineated characters closely akin. But the range of Miss Austen's portraiture was so small compared with that of Thackeray's, that he must be set above her on this account alone, unless it could be shown that she would have been as successful on the large scale as she certainly was in the few cabinet pictures on which she excercised her powers.[4]

I am particularly struck by Thack-

from his pages. But, with all its beauties and faults, who has yet found in Dickens' style, or motive, the unmistakable signs of a literary heirship or serfdom. Even the very instance of Mr. Thackeray's self-denial, Mr. Proctor adduces, is purloined, so to speak, from an earlier writer.
W.

2. Mr. Thackeray's critics have said the same thing about him, and with perfect truth. Even in the only good novel, as a novel, that he wrote (Henry Esmond), there must needs be a happy marriage of the hero and heroine to close the account; though the heroine was several years the elder of the two. And it might be asked of Mr. Proctor, in what novel of Thackeray does the villain remain unpunished, the hero unrewarded. Col. Newcome don't count—it is a common trick with novelists, (as with the world at large), when their heroes ask for bread to give them a stone.
W.

3. Let us compare these characters of Dickens with some parallel characters of Thackeray. Set against Clennam and Gay (who, by the way, are only intended to take perfunctory parts) J. J. and Frank Castlewood; against Nickleby, Harmon and Chuzzlewit, set Clive Newcome, Warrington and George Osborne; is there such a marked superiority in Thackeray as Mr. Proctor's slighting reference would imply? It may be confessed, once for all, that Dickens discovered his characters in humble life; that his portrayal of "gentlemen" and "ladies" (God save the mark! if Thackeray's presentation of English gentility is correct) is not flattering to the "caste of Vere de Vere"; that the great crowd of familiar faces which peer from his pages are characterized too strongly in some direction or other, to be met with in real life; yet his creations are true to Art and, therefore, true to nature. If a painter should attempt to characterize Murder, would the figure depicted on the canvass be a commonplace man in blouse and pantaloons with a slung-shot in his hand? Dickens' mind was essentially poetic, essentially northern. The old English poets were nearer to him in inspiration than any writer since Elizabeth. His characters were embodiments of isolated vices, passions, propensities, weaknesses and virtues. As such they are presented to us; as such we remember them, and as such we apply them in thought and word to those around us. The wonder is that these characters, these abstractions, should be given such a human interest, such a plausable, flesh-and-blood appearance, that we can scarcely rid our minds of the idea that they actually lived.
W.

4. It is curious that Thackeray should be commended for the very virtue in which he is certainly most deficient. It is not in the portraiture of character that Thackeray is greatest: Jane

eray's skill in giving life and reality to his leading characters (we must not say heroes and heroines, since Thackeray tells us he knew of none, and pretended to describe none), because it is in this novelists chiefly fail. What a vague and shadowy set are Scott's heroes and most of his heroines, though it must be admitted that Rebecca, Di Vernon and Julia Mannering are charmingly delineated. On the contrary, Esmond, the two Virgianians, the other Warrington, Pendennis, Clive Newcome, Philip Firmin and dear old Dobbin—all these are men, not (like most of our story heroes) mere names tacked on to descriptions with which they do not in the least correspond.[5]

But even more striking, though less generally recognized, or in general denied altogether, is Thackeray's power of portraying women. I find it perfectly amazing that so many deny Thackeray's power in this respect, where he is almost without a rival. Repeatedly we hear it said that he could only draw two sorts of women —Becky Sharpes and Amelia Osbornes—apart, that is, from subordinate characters.

It is noteworthy that women hold this opinion; indeed, I am not sure that they are not responsible for the opinion that all Thackeray's amiable women are fools and all his clever women rogues. Yet no opinion could be much further from the truth. Theo and Hetty Lambert suffice as illustrations of Thackeray's power in delineating amiable women who are not fools and clever women who are not only not rogues, but of sweet and attractive dispositions.

In Ethel Newcome we have the two qualities combined in still more marked degree. Surely, by the way, there is no more charming picture than that of Ethel Newcome, infinitely more attractive, with all her faults than she would have been without them, and without her noble and touching repentance.

What strikes me most in Thackeray's portraiture of women is that even those among his female characters who belong to the same category are so clearly discriminated. Amelia Sheldon is an amiable non-

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Austen, or Miss Edgeworth, or Richardson could easily vanquish him in that field. Confessedly he limned his characters, such they were, with skill; but as they were all used as the stage setting for the effectual use of satire and irony and, occasionally, wit of even coarser texture; as lay figures to be dressed up as butts for ridicule; men of straw to be jibed at, kicked, pounded, pulverized amidst the hurrahs of the audience; there is nothing so very wonderful in his skill. I don't think it remarkable that a writer who could so brutally insult his female characters (characters, too, only bad from training) whenever they are brought upon the stage, should show a marvelous acquaintance with the side of English high-life depicted by him. W.

5. Whew! I should like to ask Mr. Proctor if he ever, in the whole course of his life, met one Esmond. As for the two Virginians, they are absurd as pictures of real life; they seem to me more like the pictures painted on old-fashioned dinner plates, where trees, houses, dogs and men are all of the same size and of very much the same appearance. Pendennis, the son of a country doctor, deeming himself of gentle blood through his mother, commences a career of intolerable snobbery by airing his gentility, and yet making a fool of himself over an ignorant actress whom he wishes to marry. Clive Newcome, a most improbable character in many respects, is thoroughly Thackeraynian in making an ass of himself by posing as a martyr before Ethel Newcome after marrying poor little Rosey. And, for Heaven's sake! what spot on earth holds another Philip Firmin? Is it possible that such boorishness and refinement, ignorance of the world and god-like sagacity, strength aad weakness, good sense and silliness are wedded in any real person. W.

entity, and so is Rosey Mackensie; but no one would ever mistake one for the other or either for Fannie Huxter. There is, in fact, no more resemblance between the two than there is between Rosey's fit of jealousy when Ethel Newcome brings the news of the letter found in Orme's History and Amelia's jealous love for that young pickle, her son. Again, Laura Pendennis and Charlotte Bayham are both amiable girls, both bright and intelligent, though neither is particularly clever, but they are no more to be mistaken for each other than Captain Costigan for General Bayham or for Colonel Newcome.

So with the unamiable ladies. Apart from the difference between the social condition of Becky Sharp, Blanche Amory and Fannie Mountain, they are perfectly distinct in character, though all are clever and unscrupulous, all seductive rather than attractive. Unlike these in nearly all respects, though belonging to the same category, is Beatrice Castlewood, just as Lady Castlewood is unlike all Thackeray's other amiable women (nearest, perhaps, to Helen Pendennis) and Clara Pulleyn unlike all those of the class to which she belongs.

The development of Mrs. Mc Kensie's character from mere vulgarity to viragoism is worked out with surpassing skill. As other illustrations of Thackeray's skill in this direction I would mention the ladies of the Castlewood family and the two daughters of Sir Miles Carrington.

Thackeray seems to have taken keen delight in picturing good mothers. By the way he was a great admirer of Steerforth's mother, in "David Copperfield," the only lady in Dickens' novels.[6] A writer in the *Atlantic Monthly* a few years since said of Thackeray that he had given us scarcely any mother-characters; the *Atlantic* writer admitted, indeed, that Thackeray had given some good mothers but, oddly enough, wrote as though two good mothers were neutralized by one bad one. I fancy I could name a score at least of mothers in Thackeray's novels without considering those in the "Snob Papers," "The Hoggarty Diamond," "The Bedford Row Conspiracy," "Our Street," etc., the wonderful mothers in "The Raven's wing," and "Barry Lyndon," or the sketches in "Denis Duval."

In "Vanity Fair" we have at least five mothers—Amelia Osborne, Mrs. Sedley, Lady Southdown, Mrs. Bute Crawley. and Mrs. Becky Crawley (*nee* Sharp) herself—to count only those who are depicted as mothers, good, bad, or indifferent. Mrs. Major O'Dowd views her military family in so motherly a way that she

6. This is a queer assertion, but there is no doubt that Steerforth's lady-mother was more to the mind of Thackeray than any of the mere women portrayed by Dickens. It is sometimes startling, from an American stand-point, to discover an English definition or characterization of what constitutes a lady. Of course Proctor means that Mrs. Steerforth is the only aristocratic woman portrayed by Dickens; but he certainly forgets Mrs. Skewton and her daughter, Mrs. Dombey, Lady Dedlock and Emma Haredale. W.

might almost be counted among Thackeray's mothers. In "Pendennis" we have four mothers; Helen Pendennis, the Begum, Harry Foker's "mum," and Fanny's foolish mother—not to count the mother of Mdle. Caracole, or whatever the lady's name who adorned Foker's Richmond party. In "Esmond" there is only one "full length" mother—Lady Castlewood, (a singularly skillful drawing, by the way, if the difficulty of the subject is considered); but in its sequel—"The Virginians"—there are at least six admirably discriminated pictures of mothers—Rachael Warrington, Mrs. Mountain, Lady Castlewood the second, Mrs. Lambert. Mrs. George Warrington (*nee* Lambert) and Lady Warrington. In the "Newcomes" mothers are still more numerous. There are no less than eight—Lady Newcome, Mrs. Hobson Newcome, Leonore de Florac, Laura Pendennis, Mrs. Mc Kenzie, Barnes Newcome's unhappy wife, Lady Walham and Lord Farintosh's mother (remarkable as having been resuscitated by Thackeray, who had killed her and forgotten all about it). In the "Adventures of Philip" (with the "Shabby Genteel Story") there are six mothers—Mrs. Gann, dear Caroline Brandon (Philip is her own child we know) Mrs. Brandon Firmin, Mrs. Philip Firmin, Mrs. General Bayham and Philip's first threatened mother-in-law, Mrs. Twysden—all admirably sketched, though some with only a few masterly strokes. In "Lovel the Widower," there are three mothers, all taking active parts in that wonderful scene which follows Lovel's declaration. In all no less than thirty-three admirably delineated mothers (doubtless I have overlooked several) by the writer, of whom it has been absurdly said that he could never draw a woman.

But while Thackeray's success in delineating characters ordinarily met with in the world must be admitted by all who give the matter a thought, there are many who deny to Thackeray the power which Dickens is regarded as possessing in a very eminent degree—that, namely, of delineating such strange and whimsical characters as are less frequently met with.

Probably, if Thackeray had allowed himself the same license as Dickens in such matters, he would have been as successful in presenting in an amusing manner the grotesque, the fanciful, and the weird. The license I mean is that of combining in the same character incogruous characteristics.

This license, indeed, Dickens took with characters of all orders; and not only so, but he took the further license of distributing among different characters the peculiarities of one and the same person whom he knew in real life. For instance, we know that some of the peculiarities of Micawber were copied from what Dickens had seen in his own father, while others were taken from other originals. So Mrs. Micawber has

many ways which Dickens had noted in his own mother, while others of her peculiarities were not such as characterized Mrs. John Dickens. But we find also that while the oddities of Micawber and his wife were borrowed from different sources, so the characteristics of Dicken's father and mother were distributed among different characters—Mr. and Mrs. Nickleby, Mr. and Mrs. Micawber, and so forth.

One of the most remarkable illustrations of Dicken's manner in such matters, a manner unquestionably resulting from deficiency of the creative faculty (which, until the real origin of many of his characters had come to be known, was mistakenly supposed by inexperienced readers to be possessed by Dickens in a large degree), is to be found in Dora and Flora. Copperfield's first meeting with Dora is Dicken's meeting (when little more than a boy) with a lady by no means so young as Dora is there represented. The courtship is derived from his youthful love for the original Flora. The married life of Dora, so far as her household ways are concerned, presents Dickens' own experience, so that Dora there represents a third person, and that person his wife. And lastly the death of Dora, and Copperfield's sorrow during the following years, are drawn from the death of his wife's youngest sister, Mary, and the sorrow of Dickens felt for years thereafter. Yet, though the real Flora furnished only one of these four copies from which the Dora of fiction was combined, we find her forming part of two distinct and very unlike characters, the characteristics of her latter years being in part reproduced in Flora—but only in part, for some of Dora's ways were derived from other sources.

Nor can it be said that, after all, Dickens so artisticcally combines and distributes what he had observed, that they become effective as if they were real creations. For no one possessing any power of critical discrimination can have failed to recognize the incongrulty of many—one may almost say of all—of Dickens' characters long before it became known that he had constructed them of heterogeneous materials and applied his materials to heterogeneous purposes.

Another remarkable illustration of Dickens' manner of writing, is to be found in a picture which is commonly, and in some respects justly, admired—the childhood and death of little Paul Dombey; yet the ways of the old-fashioned child, a child with whom Dickens had been exceptionally well acquainted (himself), while the latter scenes were, it is needless to say, taken from a different experience.

And here I feel tempted to remark on a peculiarity of Dickens' manner of treating his subjects which would of itself show that he did not belong to that class of creative writers which includes all the really great names of literature.

Paul Richter used to say "If an author has to stop and ask himself, 'what shall I make such and such a character, do or say at such and such a point in the narrative?' to the devil with him," implying that such an author may possess superficial cleverness, but no genius. I wonder what Richter would have said of an author who not only thus hesitated, as we find Dickens repeatedly did, but asked and took the advice of his friends about so critical a question as the fate of his principal characters, or even after writing the closing chapter of a story adopted, at a friend's suggestion, an entirely different conclusion?[7]

No one knew better than Dickens the requirements of true art. Nay, he often describes himself as living in his work and among the characters of his story, as the true artist should live; but it is certain he deceived himself, for if he had he could never have been in doubt what their fate was to be, and still less could he have modified, at the suggestion of those who were comparatively strangers to his creations, the fate which he had decided should be theirs.

I am aware that other novelists have on occasion done likewise. Scott, for instance, consented to restore Athelstane of Coningsby to life after he had killed him, and a fine mess Scott made of that change; but, even if we assigned to Scott the high position assigned him by contemporaries, it might still be answered that Athelstane was only a subordinate figure in the story, and that Scott would never have consented so to arrange matters to suit the popular taste—that the insipid Rowena should have disappeared and the gallant but shadowy Ivanhoe have married Rebecca, that most beautiful of Scott's creations.

It need hardly be said that Thackeray does not allow himself such license as Dickens in the portraiture of character. Not a line can be found in the pictures of Costigan, Huxter, Rawdon Crawley, Lord Steyne, and the host of varied characters which appear in Thackeray's pricipal works, which can be regarded as incongruous nor can I recall a single instance in which characteristics appropriate to one character are distributed among several. Again Thackeray never, so far as can be judged, departs from that natural sequence of events which the development of his stories has suggested to him.

Thackeray was content, in fact, to hold the mirror up to nature. I do not say that the portraiture was always perfect, still less that the work belongs always to the highest class. George Eliot seems to me to be as far in advance of Thackeray in many respects, as Browning is in advance

7. There is so much downright rot and pure assumption in these criticisms of Mr. Proctor, that it is not worth while to answer him; but the dictum of Richter, as Proctor must have known, did not apply to the case presented by him. If it is a literary sin to ask advice of friends, or to build up a character from heterogenous materials, we must bid farewell to Shakespeare, to Goldsmith, to Tennyson, to George Eliott, to Thackeray himself, for they are certainly damned. W.

of Tennyson. (For this reason, she will always be less popular than Thackeray, even as Thackeray is less popular than Dickens). But the work Thackeray undertakes is always good work, and it is always well done. He does not seek to please by effective situations, by bringing in *per fas et nefas* humorous or pathetic images, though his humour is true, his pathos deep and touching. Nor does he care to make his stories "end well" or even end at all?[8] They are slices from real life, and real life moves ever onward. His pictures, if not the finest, are among the best drawn of all that English writers have given us.

I have already said much more than I intended when I began, yet I seem scarcely to have done more than touch upon my subject, so many considerations have I been obliged to omit which I had had in my thoughts. But there is one point which I must touch upon, though briefly, viz:, the quality of the language in which Thackeray and Dickens have expressed their conceptions. Here as it seems to me, the two writers hold a nearly equal position. Thackeray, it is true, wrote more accurately, at any rate in his latter works (for there is some very questionable English in his earlier writings). Dickens, indeed, repeatedly uses words in a wrong sense, and not unfrequently offends against the rules of grammar. He makes his worst mistakes when he aims either at fine or precise writing. Of the former we have a remarkable instance in a passage which Forster quotes with high approval, where Dickens speaks of a man being "an atheist in all the better feelings of our nature." Of the latter the most striking illustration which occurs to me at the moment is the passage where he says of Eugene and Bradly Headstone that "no matter who spoke or whom was addressed" they continued to watch each other. But despite mistakes such as these there is a singular charm about Dickens' English. The charm resides partly in its clearness, partly in liveliness of imagery, but chiefly I believe, in its perfect music. In order to appreciate Dickens' English fully, let some of the descriptions in his "Uncommercial Traveller" be compared with writers on similar matters, even by the ablest authors of the age. Of Dickens, indeed, we may say—though probably he himself would not have been disposed to admit as much—that "description was his forte."

Of the two writers Thackeray occupies far the higher position. His true place is daily becoming more clearly recognized. It will, I believe, be generally admitted before long that Charlotte Bronte' was not far from the truth, when she wrote (as nearly as I can recall the passage) that he was the foreman of that working body which sought to restore the

8. This is astounding! I cannot recall an instance where Thackeray did not draw his novel to a close in the most approved and hacknied method, including the distribution of all necessary rewards, retributions, etc., etc. W.

warped order of things to rectitude. As she said, his wit is keen, his humour light, but they are no more by comparison with his serious power than the sheet lightning of the summer cloud compared with the scathing flash which leaps from its dark bosom ?[9]

9. It has grown to be a superstition with a certain class of writers, that in any comparison between Dickens and Thackeray the former must suffer and that, in fact, the superiority of the latter is so apparent that a certain amount of patronizing praise is necessary in the garish light of Thackeray's genius, to prevent the total eclipse of Dickens' fame. There is a strange fatality apparent in the contemporary fame of great men. What laughter would have pealed from clerkly throats in the time of good Queen Bess, if some parvenu in literature had suggested that the plays composed by an humble actor, one Will Shakespeare, were more worthy of fame than those of Ben Jonson; and would not the literateurs of the time of King George the Third, have enjoyed the verdancy of one who asserted that Oliver Goldsmith would exert a more powerful and more enduring influence on letters than Dr. Samuel Johnson. So it was and so it is with Dickens.

The novel of Thackeray was a product of the times. It sprang from a condition of society, of thought, of taste, necessarily ephemeral. It pictured a phase of English life, narrow, insular, selfish, egotistical, which can only be interesting or useful to the people and the generation which gave it birth. It is a picture of manners, a book of etiquette, a chronicle of post-prandial bon mots, a manual for diners-out and literary snobs; in a word, it is a book for the time and not for all time. On the other hand the novel of Dickens is a picture of human life. Wherever, under the bending skies, the human race lives and moves and has its being, whether in the palaces and huts of the Orient, or the mansions and hovels of the West, in princely halls or Tartar tents, it has in Dickens a chronicler of its smiles and its tears, its beauty and its ugliness, its sublimity and its degradation. The men and women, youths and maidens and children we meet, in his pages, (and how familiar they are to us, how inseperable from the real people in our experience) are English in dress and speech alone. We have no gaudy Pendennises, no theatrical Clive Newcomes, no boorish Philip Firmins (look them up pray, good reader, if you have not met them) among our circle of friends; but, thank Heaven? there are Nicklebys, Copperfields, Martin Chuzzlewits, aye, and breezy, hearty, wholesome, Walters too. Ah, how they troop into remembrance, those citizens of the world—those "abstracts and brief chronicles" of human nature,—with the whole Pickwick Club as marshals of the day! Dear old friends, their creator has left to them the task of perpetuating his fame, and not to scribblers and penny-a-liners. Taine's words, in drawing a parallel between Balzac and Thackeray, may be paraphased as follows with perfect truth and justice: "When we have read to the end of Dicken's novels, we feel the pleasure of a naturalist walking through a museum, past a fine collection of specimens and monstrosities. When we have read to the end of Thackeray, we feel the shudder of a stranger brought before a mattress in the operating room of a hospital, on the day when cautery is applied or a limb is taken off." W.

EDITORIAL.

THE NEW STAR.

E. W. Maunder discussing the "New Star in the Great Andromeda, in the Observatory for October, says: It is premature, no doubt, to attempt to draw any very definite deductions from the present outburst; but it should always be clearly borne in mind that these "temporary" stars—and that this star may properly be classed as such is evident, for it is already fading—cannot be stars in the least resembling our own sun in size or structure. Could the radiations of the sun be suddenly increased a thousand fold, it would be absolutely impossible for it to resume its former scale of brightness within the course of a few weeks or months. The suddenness of the increase and sudden decrease of light, prove unmistakably that we have to do with bodies relatively minute, and therefore capable of rapid cooling. The only alternative—that the star has not really altered its lustre, but that some intervening screen has been temporarily withdrawn—seems inadmissable, especially in view of the spectroscope history of *T. Coronæ* and *Nova Syni.* Since, then, the distance of these stars is so great (for as yet an appreciable parallax has not been obtained for any one of them) and their brilliancy so high, we are compelled to substitute for a compact sun a loosely scattered, widely extending system of small bodies—a system similar in character, but on an indefinitely larger scale, to that which we see in the corona or in the rings of Saturn.

Another writer in the same magazine suggests that outbursts like that in Andromeda might be caused by some celestial body coming in contact with a gaseous Nebula, causing its light to be greatly intensified.

THE TAENSA LANGUAGE.

The controversy between Dr. Brinton and M. Adam arising out of the latter's book on the Taensa grammar and literature, does not seem to have been terminated by the reply of M. Adam to Dr. Brinton's criticism. In the October *Antiquarian,* Dr. Brinton returns to the attack without abating his personal distrust of the genuineness of the Taensa grammar and texts, as fathered by the French *Americaniste,* and alleges that Adam has retreated so far from his original position as to leave nothing in dispute but the authenticity of the grammar. As to this point the celebrated philologist, Friedrich Muller, says (translation) "I think, therefore, that the Taensa Grammar, in general, is genuine; that one can use it as the material to form a judgment of grammatcal structures; but it is better to avoid using this material so long as the original manuscript shall not be produced." At the conclusion of his reply, M. Adam avers that "*la France n'est point la terre classique de l'imposture et du* humbug"; to which Dr. Brinton makes the pertinent response that the only other kindred imposture

to the one which Perisot is accused of, was perpetrated by a native of "la France"—George Psalmanasar.

THE AMERICAN ANTIQUARIAN.

One evidence of the continued prosperity of this valuable magazine, is given in the fact that it is absorbing various amateur journals, and surviving all competitors in the same department. The editor announces in the September number that the *Museum*, a monthly recently established in Philadelphia, has been merged into the *Antiquarian*, and that all of the contributions, correspondence, engravings and subscription list have been already transferred. A new department called the "Museum," devoted to the description of archæological relics has however been established, and Mr. E. A. Barber, the editor of the *Museum*, is to have charge of it.

Archæology is now the rising science, and it is a cause for congratulation that a magazine which is as safe and careful, and at the same time as progressive and scholarly as the *Antiquarian*, should be able to hold the field, and unite the workers of all classes.

TUBERCULOSIS IN CATTLE.

In a paper read before the Newport Natural History Society, Mr. J. M. Heard, a veterinary surgeon of repute, assserts that the *bacillus tuberculosis* of man is the same as that of bovines. He says that under artificial cultivation the bovine *bacillus* behaves the same as the human *bacillus tuberculosis*, and that cattle inoculated with the sputa of human tuberculous patients become tuberculous. The milk from tuberculous cows does not produce tuberculosis unless the udder is the seat of the disease. In that case, many instances show the danger of using the milk. An article in the October *Journal of Comparative Medicine and Surgery* (where also Mr. Beard's paper may be found) urges the necessity of a sanitary inspection of our milk supply, with a view to eradicating the danger, among others, of infecting children and milk-drinkers with bovine *bacillus* of *tuberculosis*.

ANTIQUITY OF MAN IN AMERICA.

Von Koseritz has just published a series of Anthropological essays, based upon his investigations in Brazil. His conclusions are, that the early American races were equally as ancient as the River Drift men of the old world, and that they were not the same type as modern Brazillian nations.

In *Science* for October 9, there is an extremely interesting paper on "Racial Characteristics of Jews," illustrated with portraits of five Jewish boys, and a composite made from them. It is curious to note the apparent wide difference in the features of the several faces represented, and observe the result in the composite. This shows a noble and beautiful face with the race-characteristics shaded, yet prominent. It resembles faces from the sculptures of Ninevah and Babylon.

Some time since a startling paragraph was current in the papers about a new telephone, invented by a Texan of the name of Brown. It was said that his invention would revolutionize telephony, and that he had sold an in-

terest to eastern capitalists for $1,000,000. It turns out, however, that the only patent thus far issued to the Texas genius, is for a new form of key, combined with the use of a Bell Telephone, in lieu of an ordinary telegraph sounder.

THE sixth volume of Dr. Brinton's Library of Aboriginal Literature is now in press. It is the annals of the Cakchiquels, and will be printed in the peculiar alphabet of the tongue. The annals were written about 1560, by a native of Guatamala.

A FLOATING dome was recently presented to the observatory at Nice. Instead of being mounted on rollers, this dome will rest on a reservoir of water. It is claimed that the suspension is so delicate that a single person can turn it round the horizon.

SAN FRANCISCO has good cause to discredit the wide-spread doctrine that wealth is inherently selfish and conservative. Already possessing one of the most remarkable libraries in the world, through the munificence of Mr. H. H. Bancroft, she will shortly boast another as the gift of another wealthy citizen, a Mr. Sutro.

SCIENTIFIC AND INDUSTRIAL NOTES.

A MATHEMATICAL THEORY OF EVOLUTION.

The following is the kernel of Mr. Cave Thomas' lecture on "The Bases of a Science of Æsthetics," which has not only an immediate bearing on the subject treated, but on the entire aspect of scientific thought. In reply to the question, "What were the bases of a science of æsthetics?" he said: "His audience were perhaps aware that philosophically it was a well-recognised fact that we know nothing of the external world absolutely per se, but only phenomenally, or as it appears to us in sense. We had, therefore, to ask ourselves whether there be any common and fundamental characteristic of those phenomena.

Speaking more immediately with reference to the sense of sight, the knowledge of external existence comes to us by means of the telegraphy of vibrations, which impresses miniature images on the retina. We never even "see things," as we express ourselves in their actual, but only in their relative proportions; and when we come to analyze the different kinds of impressions on the sense of sight, we find that they are manifested in the three fundamental modes of consciousness—viz:, in space, in time, and in force; and the important truth to be deduced from this, is that these three modes are alike quantifiable, that is to say, the terms more, less, equal, etc., were producible of the the three modes; differences in the sensations of light, colour, are therefore fundamentally quantitive, or proportional differences, differences in light and shade are also fundamentally quantitive, or proportional differences, and so also are differences in the configuration and superfices of visible images. It may be perceived, then, that the form of all visual phenomena, is quantitive. Hence the conclusion that all the relations of phenomena, recognized by the sense of sight, whether pleasing or displeasing, are fundamentally proportional relations and the science of æsthetics, a science of definite proportional relation—that is to say, the beautiful in form, in colour and in light and shades, consist in those definite proportional relations which are opposite to the sense of sight, to the eye, and these it is the aim of a science of æsthet-

ics to formulate. The lecturer, however, has not limited his investigation to the sense of sight; he has analyzed the phenomena of the other senses, and has been led to make the following important generalization, which he believes will affect the whole future current of human thought, viz: that the form of phenomena, of experience, of knowledge, is quantitive. If this be a correct generalization, then adaptation to purpose, fitness, resolves itself into adaptation of proposition to purpose; evolution development, into the becoming of the proportioned in all things; politics into the proportional adjustment of material interests, and of social relations; ethics into the science of proportioned conduct; hygiene into the science of proportioned living; education into the science of training and developing a proportioned or beautiful race; æsthetics into the science of proportioned taste; and fine art into proportioned art. Mr. Thomas has completed a work treating all the above subjects fully on this mathematical basis.—Knowledge, June 5, 1885.

PHOSPHORESCENCE.

Near to my house there is an avenue of lime-trees, the growth of which is so luxuriant that the foliage almost shuts out the direct rays of light, and in this avenue, at half-past ten last night, I noticed a phenomenon that you may esteem worthy of chronicling.

The directlon of my walk was northerly, and I noticed that the leaves, and the air in their vicinity, were suffused with a soft, faint, phosphorescent light. This for a time I attributed to the vapour from the wet leaves being illuminated by the the moonlit clouds at my back, but, to settle my doubts, I examined a dense mass of tress from their shady shide, and found she light still distinctly visible, but, I think, not attributed to the moon. I believe some flowers are said to emit light. Are trees known to possess this power, and have the causes been unravelled ?—A. D. Barnes, in Knowledge, June 19, 1885.

A MODERN MOUND BUILDER.

I herewith send you the following description of a mound, opened by one of the Bureau Assistants on the Bluff back of Dunleith, Illinois.

This mound is conical in form, very symmetrical, sixty-five feet in diameter at the base, and ten feet high. It was found to contain a rectangular vault, thirteen feet long and seven feet wide, (inside measurement). The surrounding wall, three feet high and of uneven thickness, was rudely built of stone. Three feet from each end was a cross wall or partition of like character, thus forming a main central chamber about seven feet square, and a narrow chamber or cell at each end something over two feet wide and seven feet long.

The whole vault had been covered over with a layer of logs extending across the width of the vault, and their ends reaching slightly beyond the side walls.

In the central chamber were found eleven skeletons, six of them adults, and four children of different sizes, and one infant in the arms of one of the adults, probably its mother. They had all apparently, been interred at one time, and arranged in a circle in a squatting or sitting posture, against the walls.

In the centre of the space, around which they were grouped, was a fine large shell of Pyrula perversa, which had been converted into a drinking cup by removing the Columella. There were also numerous fragments of pottery.

The end cells, walled up as heretofore stated, were filled with a very fine chocolate colored dust, which gave out such a sickening odor when first uncovered, that the workmen were compelled to stop work until it had evaporated.

The covering was chiefly of oak logs, nearly all of which had been peeled, and some of the larger ones had been somewhat squared by slabbing off the sides, and the slabs and bark thus removed, together with the small brush, had been laid over them.

Over the whole vault, thus covered, had been spread layer after layer containing lime, each succeeding layer thicker and

harder than that below it. Over this was a foot or more of soil.—Cyrus Thomas, in American Antiquarian.

THE FUEGIANS.

The average height of twenty men of the Tekeenika of Yaghan race, from Orange bay, was found by M. Hyades to be 1.576 meters, that of twenty females 1.478 meters, a difference of nearly ten centimeters in favor of men. The tallest man reached 1.660 meters, and the tallest woman 1.577 meters. Although the inhabitants of this district are few in number, the size of the families seems to show that they are not diminishing. The Yaghans of the Beagle river number some 800, and have for neighbors, at the extremity of Beagle strait, the race of the Ona, living in the mainland of Terra del Fuego. This race is friendly with the Tekeenika, but those who were seen fled the presence of the white man. The Ona are, says M. Hohn, as tall as, or taller than the Patagonians. Five entire bodies (preserved in alcohol) are in the collection brought to Paris by Romanche. These are publicly exhibited by casts, and a hundred casts taken from life, representing every part of the body of individuals of both sexes and all ages, are either exposed publicly, or retained as a special collection open only to naturalists and physicians. Numerous photographs taken from every point of view, some of them representing the natives engaged in the various occupations of their simple life, add value to the collection. Every female of two years of age and upwards wears the machakana, a small triangular piece of guanaco skin, fastened around the haunches with a plaited band of whale-bone fibers. Every Fuegian carries also a mantle, which is but a simple skin of otter, seal or guanaco, imperfectly serving as a protection from cold. Bracelets, necklaces of shell, etc., are also worn by the women; and the men often wear a band of feathers or down, usually of Bernicla anartica. The only cutting instrument of the Fuegians is a knife of the Mytilus shell fastened to a stone handle with shreds of sealskin. The fishing lines, made of the stems of macrocistis pyrifera, or of whale-bone fibers, end in a running knot furnished with a hook made from a feather. Fire is obtained by striking together two pieces of pyrites, and with the spark enkindling a mixture of the down of birds and fine scrapings from Berberis or Drimys. These scrapings are used also as sponges or napkins.—Amer. Nat., September, 1885.

USE OF SPINES IN CACTUSES.

Our brethren across the water, assuming that thorns are simply for protection in a military sense, are exercising themselves in their serials over the spiny leaves of the holly. When young and vigorous, i. e., in early life, the teeth are very spiny; when the tree is aged, and the branches then a distance above the surface of the ground, losing the vigor, the spines are weak or absent. Sir John Lubbock and others, following the poet Southey, see in this a beautiful adaptation for protective purposes. When within the reach of animals, spines are borne; when high up where animals cannot reach, spines are unnecessary. Numbers of species of plants have mucronate points to the leafy serrature, which are wanted in maturer years. It is at any rate difficult to imagine why a sharp point should be made especially for protection, and points less sharp for no protective use at all.

I have often reflected on a fact referred to by Dr. Newberry, that our thorniest plants are in much greater proportion in places where animal life is scarce, and the immense police force sustained by the great vegetable community absolutely thrown away. Cactuses and other thorny things I have seen covered with thorns and spines on deserts where the hot air seemed to be bounding up and down like the surging ocean, and where not even a lizard could have dared to show its face. Thorns cannot be, so I have thought, for protection where the climate gives all the protection desired. I am not one who doubts that nature has a purpose in every move she makes, but the main purposes I think we seldom reach, and that we do ourselves an injury in research by assuming mere inci-

dental uses as the main purposes for which structures seem to be "adapted."

One of these uses in the spines of cactus has occurred to me. They break the full force of the sun on the plant, a force it is made to endure and not to love, as we know who have learned to cultivate it. Plant lovers set out their treasures in summer under "arbors" of fish netting or galvanized wire, and those who have no experience would be surprised to find how the moving shadows of the twine or wire lower the temperature. A mass of spines on a cactus must have the same effect. A cactus does not need much light on its epiderm to keep healthy. On the dry mesas along the Uncompahgre River I have seen some aggregated masses of Echinocactus phœniceus forming dense hemispheres a foot high and as much wide, with spines so thoroughly interlaced with spines as to rival the hedgehog, and leaving not a particle of the green surface visible; and there are species not cæspitose, such as E. pectinatus, which no one can see for spines without cutting apart, and forming a complete protection from the hot suns under which they are doomed to live.

I do not suppose I have yet reached the final purpose of spines in a cactus any more than we have the final purpose in the existence of the cactus itself, but that one use of cactus spines is to furnish a partial shade I feel to be beyond a doubt.—Thomas Meehan in Bull. Torrey Botanical Club.

WEATHER REPORT FOR OCTOBER.

Prof. Snow furnishes the following October weather report:

With one exception (1869) this was the coldest October on our eighteen years record. It was the fourth successive month with rainfall above the average. The cloudiness, wind velocity, and atmospheric pressure were all below the average. The first white frost of the season occurred on the 4th, three days later than the average date; and the first black frost followed on the 6th, thirteen days earlier than the average date.

Mean Temperature—51.22°, which is 3.55° below the October mean. The highest temperature was 77° on the 16th; the lowest was 29° on the 6th, giving a range of 48°. Mean temperature at 7 a. m., 43.39°; at 2 p. m., 62.57°; at 9 p. m.; 49.45°.

Rainfall—3.32 inches, which is 0.43 inches above the October mean. Rain fell on 7 days. There were 2 thunder showers. The entire rainfall for the 10 months of 1885 now completed, has been 34.27 inches, which is 2.69 inches above the average for the same months in the preceding 17 years.

Mean Cloudiness—38.92 per cent of the sky, the month being 1.69 per cent. clearer than usual. Number of clear days (less than one-third cloudy) 16; half-clear (from one to two-thirds cloudy) 8; cloudy (more than two-thirds) 7. There were nine entirely clear days and three entirely cloudy. Mean cloudiness at 7 a. m., 44.84 per cent.; at 2 p. m., 41.29 per cent.; at 9 p. m., 30.64 per cent.

Wind—N., 22 times; N. W., 17 times; S., 14 times; S. W., 12 times; S. E., 10 times; N. E., 9 times: W., 5 times; E., 4 times. The total run of the wind was 9,350 miles, which is 2,442 miles below the October mean. This gives a mean daily velocity of 301.61 miles, and a mean hourly velocity of 12.56 miles. The highest velocity was 55 miles an hour, from the north, on the 28th.

Barometer—Mean for the month, 29.089 inches; at 7 a. m., 29.108 inches; at 2 p. m., 29.087 inches; at 9 p. m., 29.031 inches; maximum, 29.416 inches, on the 8th; minimum, 28 795 inches, on the 15th; monthly range, 0.621 inch.

Relative Humidity—Mean for the month, 70.1; at 7 a. m., 85.1; at 2 p. m., 48.9; at 9 p. m., 76.3; greatest, 100, on 12th and 18th; least, 27, on the 3d. There were three fogs.

ST. LOUIS OBSERVATORY.

The new observatory at Washington University is about completed, and bids fair to be one of the most perfect in the country. The earth upon which it is built at the corner of Eighteenth and St. Charles streets, is of a peculiar stiff clay, which allows very slight transmission of vibration, and conse-

quently the observations will not be appreciably interrupted by the jarring of the building from external influences. Prof. Pritchet, who has charge of the astronomical department, is making preparations which, when completed, will insure a most instructive and interesting year's work. Through the generosity of a few public spirited citizens he has been enabled to contract for a new telescope and clock, which were much needed, and the character of which will place this institution among the first in the country. The object glass of the telescope is six and a half inches, and was made by Alvin Clark, of Cambridge, and the focal length is to be eleven feet. This instrument when complete will have sufficient power to discover a body as small as the custom house in this city on the surface of the moon, and with this Prof. Pritchet purposes to operate during the fall and winter in his exchange of signals with the observatory at the City of Mexico, It is also proposed to enter upon a course of observations to determine the truth or falsity of the nebular theory or system, which has become an interesting question of late, owing to the discovery of one first magnitude star and a smaller star in one of the heretofore unoccupied spaces. The cost of this telescope will be nearly $2,500.—St. Louis Globe Democrat.

EXPERIMENTS WITH A NEW EXPLOSIVE.

Experiments with nitro-glycerine and other explosives have just been concluded by the School of Gunnery at the new ranges at Lydd, England. They have been chiefly directed to ascertaining the effects of shell fire where the shells have been charged with high explosives. Some remarkable results have been achieved.—Tests have also been made with a highly explosive material manufactured by a German maker. The material is composed of two ingredients, one of which is nitric acid. This is placed separately in glass bottles, which are put into the shell. In this condition, they can be handled with impunity by the operators. The explosion is caused after the shell has been fired by means of a detonater, the two substances mixing when the bottles are broken by the concussion. The result of the explosion of these two substances is described as far more terrible than that of nitro-glycerine. During the experiments with nitro-glycerine, one of the howitzers burst, and the breech of the gun was completely shattered. The gun was fired by electricity, and those engaged in the operations were fortunately under cover.

IMMORTALITY OF UNICELLULAR ORGANISMS.

Professor A. Weismann (Biolog. Centralblatt., iv., pp. 577-591, and 650-655) believes that the idea of a senescence of unicellular animals is not tenable.

Physiologically speaking, there is a profound difference between the uni-and multicellular organisms in the fact that the latter only wear themselves out by living, and proceed to a natural death. The unicellular animals are never so modified by the transformation of matter that life becomes impossible. They have no physiological death; their bodies are immortal.

GRANO-METALLIC STONE.

Under this name, a new material for footpaths and roadways is in course of introduction. It is composed of certain proportions of blast-furnace slag and granite, which are crushed, chemically treated, dried, and mixed with Portland cement. For use, these ingredients are formed into a paste with an alkaline solution, and laid on a substratum of rough ballast, a smooth surface being imparted at the finish. This artificial stone is laid with facility and sets rapidly, being ready for passenger traffic in ordinary weather in about twelve hours. It is fire-proof as well as water-proof, and one of its important features is, that it is not slippery on the surface—a circumstance that is due to the particles of hard vitreous slag always presenting themselves just beyond the other ingredients, which yield more readily to wear. Judging from a sample length of this stone laid down in the

Strand in front of the Gayety Theater, it promises well as a cheap and durable paving. It is the invention of Mr. J. H. Bryant, No. 45 Palace Chambers, Westminister, London, and has been adopted by several of the leading railroad companies, besides which, contracts have been executed in some of the suburban parishes and provincial towns.

THE PHILOSOPHY OF FLAME.

In the study of furnaces, F. Siemens says that large ones must replace small ones. He claims to have proven that solid substances interfere with the formation of flame, and that flame injures solid substances with which it comes in contact. To account for the phenomena he advances, preferably, an electric hypothesis. Accordingly he explains flame as the result af an infinite number of exceedingly minute electrical flashes, the flashes being due to the very swift motion of gaseous particles, and a solid body which opposes itself to these flashes is cut by them, while the motion being more or less arrested by the solid body, the flame is dampened. Mr. Siemens insists, therefore, that flame must not be allowed to impinge on bodies to be heated, but must simply heat the bodies by radiation, and furnaces must be so constructed as to allow the flame to develop out of contact, not only with the substance on its bed but with the walls and roof of the furnace itself.

A REMARKABLE MAN.

According to the Cincinnati Enquirer there resides about four miles east Owingsville, Ky., a man who is indeed a prodigy. The name of this wonderful man is Reuben Fields, and he has but one developed faculty, this one seeming to take entire possession of him, driving all other thoughts from his mind. In early infancy he was apparently much as other children, but in extreme youth he developed a wonderful precocity, or rather a supernatural endowment for mathematics, even then solving difficult problems with apparent ease and with but little study. This became a mania with him, and grew as he grew, to the exclusion of all other branches or thought, until finally, without knowing a single figure or letter of the alphabet, he became the perfect master of the science of mathematics. He has been tested by the most scientific men of this profession, and the answers to the most difficult problems that they have been able to propound are at his fingers' end, the invariably correct solution being given in an instant, quicker than thought.

As an instance of his remarkable powers, he has been known to keep more than a dozen clerks busy in taking invoice of a stock of goods. Indeed, his knowledge and application of the science of mathematics far exceed anything that the most scientific men are able to comprehend. Another phenomenal characteristic of this man is that he can tell the time to a second, either day or night. Awakened from the soundest sleep he can tell you, without hesitation, precisely what time it is. What Blind Tom is to music, Reube Fields is to mathematics; and, like that illustrious idiot, this one branch absorbs his entire mental capacity.

Another peculiarity of Fields is his utter fearlessness of snakes. In his childhood he manifested a fondness for these reptiles and made them his playthings, and, strange to say, he was never bitten, though he handled with great carelessness and freedom the most poisonous species. He is very superstitious, and believes his extraordinary powers direct gifts from his Creator, and says that were he to reveal the secrets, or use them for the purpose of gaining more than the necessities of life, he would expect to be deprived of them immediately. He has more than once refused offers of handsome salaries. His parents died sometime ago, since which time Fields has been roving around among his kindred, staying with each a greater or less length of time, according to the nearness of kinship.

He is very fond of playing checkers, and it is said that he has never yet met his match at this game. He is annoyed a great deal by people who are curious to see his extraordinary powers exhibited, and he says that this is his greatest trouble, for

whether he will or not, when a problem is presented the solution is bound to flash through his mind.

SAND DUNES.

The great sand dunes along the banks of many rivers, and particularly along the shores at the southern end of Lake Michigan, are due to the presence of the Ammophila Arenaria, or sand-gathering grass, which possesses a remarkable power of drawing up moisture. Indeed, it may almost be called a miniature water pump, for it is able to keep the earth wet for several inches around it. This wet earth catches and holds the drifting sand. The process goes on, the grass growing and the sand collecting, until a great sand dune is the result.

ORIGIN OF THE DIAMOND.

Perhaps it will be best to first state briefly two or three of the various theories which have been advanced:

1. Sir A. C. Ramsey, has urged that the real home of the diamond is in the schistose orgneissic rocks, of high antiquity, which are known to underlie the Kimberley shales, and which in other regions are even more directly associated with diamonds. From the broken and imperfect state in which the diamonds of South Africa are frequently found, it is certain that they cannot have been formed in the exact situation in which we now find them, while the fragments of gneiss which also occur in the mines prove that the diamond rock must have passed upward through the gneiss.

2, Professor H. G. Seeley, has suggested that carbonic acid found its way downward together with the water which (after its conversion into steam) has been shown to be the principal cause of volcanic eruptions. The carbonic acid was decomposed by heat, and then, under great pressure, the liberated atoms of carbon built up the crystalline form of that element known as the diamond.

3. Reasoning from the experiments of Mr. Hannay, it seems not impossible that the diamonds may have been derived from the carbonaceous matter contained in the shales through which the diamond rock passes. Not from those shales which form the walls of the present mines, but from shales occurring at a greater depth, and through which the intrusive bronzite has previously passed. If this be the case, it is clear that the supply of diamonds will cease when the shales have been worked through. In any case, the deepening of the mine will shed light upon the problem. Under the great pressure and high temperature to which the hydo-carbons in the shales would certainly be subjected at the time of the outbreak by which the existing pipes of volcanic rock near Kimberley were formed, the hydrogen of these hydro-carbons would be strongly attracted by the metal magnesium which now forms part of the bronzite. The carbon atoms—set free in this way—under the enormous pressure to which the whole mass would then be subjected, might aggregate together to form diamonds.

In any case, it is impossible not to agree with Professor N. S. Maskelyne when he says: "It is possible that carbon, like metallic arsenic, passes directly from the state of a solid into that of a vapour; and that the conditon for its sublimation in the form of crystals, or its cooling into the crystal diamond, is one involving a combination of high temperature, and high pressure present in the depths of the earth's crust, but very difficult to establish in a laboratory experiment."

Although, in the future, the geologist and the chemist must work together in the interesting task of discovering the mode of genesis of the diamond, yet it is clear that the onus of the direct proof must lie with the latter. In years to come, when the rocks of the diamontiferous regions shall have been mapped and studied as accurately and thoroughly as those of England have been, the geologist will probably be able to accurately locate the diamond in its true home—in the rock in which it was produced.

But as to the mode of its origin in that rock, the chemist will have much to say;

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nor will the proof be considered complete until diamonds are produced artificially with certainty and ease. That they will be so produced the writer of this article considers certain, and if chemists had been able to command the expensive appliances necessary for the performance of the many and intricate preliminary experiments required —experiments which may involve years of failure—it is probable that success would have been attained ere now. When the Edison of chemistry arrives, artificial diamonds will be successfully made; they will perhaps, not be ornamental as those occurring naturally, but there is a wide field of usefulness awaiting such a product in the arts and manufactures.—Knowledge.

LAND BIRDS AT SEA.

The following story is credited by The New York Sun to a passenger on the steamship George W. Clyde from the West Indies:

"On last Monday evening the nearest land was the northeast end of the island of Abacoa, and this was 200 miles south-east by east. The Bermudas were 420 miles distant, and Turk's Island 440 miles. There was no wind at sea, and rain was falling heavily. Almost all of the passengers were assembled in the smoking room amidships. The room was small, and the door had been left open for ventilation. Suddenly a little bird fluttered in through the open door, darted against the lamp, and fell upon the floor. Another and another followed. Twittering was heard outside, and we found the decks covered with hundreds of winged creatures. They seemed to come from every side, attracted by the steamer's lights. In a few minutes, more than fifty had entered the smoking-room, and bedraggled little wretches they were. Their long flights had used them up. We could take them up like so many blocks. We put all that entered the smoking-room under some hats and left them for the night. Outside their comrades perched on the rigging and covered the decks. Great numbers of them were killed by flying against the stateroom windows. Their little bodies were scattered all about the ship. While we were attending to the birds in the smoking-room some larger birds that had perched on the rigging were caught by officers of the ship. Among them were two hawks, one of them of the smallest known variety, the Kestrel, and the other a common hen hawk. Hawks are generally shy, but so tired were these two that they allowed themselves to be captured. The big one, however, made savage fight, and drove his talons nearly through the palm of his captor's hand. We kept him for two days, but he would not eat, and finally he escaped."

"Besides the hawks, two water rails were caught, and some birds that resembled our catbird, but they were larger and had brown wings. They were probably a species of jay. The small birds were a little larger than a canary and of three varieties. One kind was yellow, and another brown, and the smallest and most numerous were gray, with very sharp beaks. In the morning we found a kingfisher perched in the rigging. He was rested, and we could not catch him. He would circle about the ship a few times when started, and then alight somewhere else on the ship. There was a little owl, too, that kept the kingfisher company, but he soon disappeared. We intended to keep some of the birds that were caged in the smoking-room, but when the boy entered to clean out in the morning he saw the hats there, and, gathering them up, to his surprise a flock of birds suddenly fluttered about him, and then flew out of the open door. They were very tame and perched all about the vessel. The officers of the watch said they could hear birds flying against the side lights of the ship and dropping into the sea all night. It is evident that there were thousands of birds flying that night. We treated our visitors as well as possible, and gave them plenty to eat, but they did not seem to appreciate our hospitality, and by noon almost all of them had left us.

"How to account for the appearance of these birds is a question. There were men on board who had traveled about the world for forty years and never had heard of such

a phenomenon, much less seen it. There was no wind. For two days before and after the birds appeared you could have pulled a shell in safety on the ocean. Our theory is this: Abacoa, one of the Bahamas, is celebrated for birds, You may know of its proximity by the birds that fly about the ship, Now, the birds that came on board on Monday evening were Bahama birds, and they are found all about the island of Abacoa. We concluded that there was a local whirlwind, or tornado, that took up all the land birds of a certain district, and that afterwards, by an upper current of air, they were swept out to sea. There was no surface wind, or we should have felt it. The storm could not have been general, for the effect of wind at sea is felt often in the swell of the ocean, when there is no apparent air current. We get the swells of storms hundreds of miles away, but on this occasion there was no swell. So the tempest must have been local. Now, as there was no surface breeze, there must have been an upper current that swept the birds along after they were taken up, for it's a physical impossibility for many of the birds we found to fly 260 miles, the distance of the nearest land. I do not believe the small birds unaided could have done it. Any one who has hunted rail birds knows that that bird could not fly half the distance. The rail is a marsh bird. He loves to dabble in the mud along shore where the reeds and rank grasses offer cover. If he is hunted he takes to his legs and quickly hides himself. His wings are ill fitted for long flights, and he seldom rises. Now, two of these shore-loving rails ran against us 260 miles from land. Mother Carey's chickens are often found in mid-ocean, but they are peculiarly a water fowl. The birds we saw were all land birds—never found so far at sea, unless by accident. This theory is strengthened by the diversity in the birds. There were nine species; three varieties of small birds, two of hawks, an owl, a kingfisher, a sort of jay and the rails. You couldn't find a more heterogeneous lot.

"It seems plain that some force collected them and drove them to sea. We kept some of them in the boats until off the coasts, and then liberated them. There were two rails—a male and female. The male escaped a day out from New York, and the female was the bird that made off for Staten Island when we were in the Narrows. I do not believe that any of the small birds that left us in mid-ocean got to land. They had a night's rest, it is true, but they were desperately tired for all that, and had no wind to help them back."

THE AXOLOTI.

The transformations in case of the amphibia from the larval to the very different adult form have furnished common and interesting cases of metamorphosis, which all have witnessed. Perhaps the most curious representative of this group of animals is the axoloti, which inhabits the high plateaus of the Rocky Mountain region, from Montana to Mexico. The animal is ten or twelve inches long, fish like in form, but with four legs, a long tail like that of a salamander, and a tuft of gills on each side of the large, flatish head. Specimens were taken to Europe many years ago. At the Jardin des Plantes one of these animals left the water of the aquarium in which it was kept. It had lost its gills, but they were replaced by lungs. An experiment was then made on specimens kept by Freulin Marie von Chauvin. She removed them from the water, kept them in damp moss, and thus actually forced them to transform into the gilless, air-breathing state. They then somewhat resemble the large yellow spotted salamander (Amblystoma) so common in this region. Previously it was supposed that the larval, or gill-bearing stage was the permanent one, especially since in it they breed—lay eggs which hatch into similar forms, as is the case in permanently gill-bearing species. The adult is not so large as the larval form giving us as Packard has said, an epitome of what has happened in the life of this and other classes of animals. For the fossil forms were monsters, yet larval and premature as compared with their descendants. Extended experiments have been more recently made upon these ani-

mals by the same lady. She found that younger specimens could be more easily forced to transform than older specimens. If the water in which they are kept contains but little oxygen, so that they must come frequently to the surface for air, they transform more readily than if the water is thoroughly ærated. Freulien von Chauvin then tried the experiment of converting the axoloti back from the higher stage to the lower. In this she succeeded, or at least a vigorous larval animal fifteen months old, after being transformed to the adult stage (which required twelve days), and being kept out of water for another fifteen months, was brought back again to the water, to which element it accommodated itself in the course of six days. Here it lived three and one-half months. Then it was again forced to live on land, which it did six months—till the time of its death.

Some animals were kept in a state of suspended metamorphosis for three years; that is, when partially transformed, further change was prevented by low temperature and being placed at night in the water. Then some of these partially transformed specimens were forced to return to the larval stage (axoloti), and the others to the higher stage (amblystoma). It was believed for a long while that the axoloti in its native regions never transformed to the amblystoma stage; but it has been proved that, while many do not, certainly others do. The latest observations were published in Science last July. Dr. Shufeldt, located in the northwest part of New Mexico, has kept the animals in aquaria, studying their habits and propensities. He has also had opportunity to watch them wholly undisturbed in their native ponds. He corroborates the several statements made by Freulien von Chauvin. He finds also that they are very voracious animals, and that if fed abundantly with meat, the amblystoma, or adult animal, is much larger. The deeper the water in which they are placed, the less likely they are to transform; but in shallow ponds that have little or no vegetation, where the bottom is formed of hard clay, the larval form is longer retained, and the color of the animal, though usually quite dark, becomes, in this case, very light. During the past summer, Dr. Shufeldt saw the pond, where were multitudes of these animals, rapidly dry up. Those caught by the disappearance of the water in their quarter, disappeared in the mud, and, just beneath the surface, very quickly transformed to the lung-bearing stage, and left for adjacent woods. Others in deeper water remained undisturbed. If a rain came suddenly, refilling the dried pond, the further change of the half-transformed axolotis at once ceased, and they continued to live in the water as before. But subsequent drying would compel them to take on the adult, or amblystoma stage.—Prof. Kellerman, in Industrialist.

THE CARBONIFEROUS AGE.

An editorial in the Mining Review of Sept. 17, 1885, under the heading of "The Foundation," states that, "if our store of coal was all 'created' and laid away for future use there is no special advantage to be gained in endeavoring to ascertain the laws and causes most active in its formation."

It seems to me, as a representative of large tracts of mountain lands, that there are great advantages to be gained in ascertaining even the probable laws and causes most active in the formation of coal; and that it is of vital importance to know in what formations to look, and where to spend money for exploring, with a reasonable prospect of success; and in this connection it becomes a matter of practical interest, in dollars and cents, not only to the land owners, but to the whole community, to know at what period in the formation of the earth's crust the carboniferous age commenced.

According to the theory of the most popular geologist of the Nineteenth century, the carboniferous age did not commence until after the deposit of the sedimentary formation called the seral conglomerate of the Pottsville coal basin; being Formation No. XII of the Pennsylvania nomenclature, the carboniferous age being all included in Formation No. XIII, and they pronounce any

man who looks for coal below that formation an imbecile, or worse.

Under this theory, the greater portion of the land in the world is laid under the ban of modern geologists.

Limestone, as well as coal, is classed by these same geologists as of organic origin, for the reason that some of these formations contain fossils, indicating animal and vegetable life; they assure us that the limestone Formation No II which, in some portions of the State of Pennsylvania, is said to be 6,600 feet thick, was deposited in the bottom of the ocean by the same animals which form the coral reefs along the coast; and yet we find this limestone underlaid by the sedimentary Formation No. I, called the Pottsdam sandstone, which is practically conglomerate rock.

We are assured by chemists that carbonate of lime contains about twelve per cent. of pure carbon, so that we should have nearly eight hundred feet in depth of pure carbon locked up in this Pennsylvania deposit of limestone Formation No. III. Admitting that it was formed of shell (which I do not), where did the shells obtain this vast quantity of carbon, if not from the ocean? And if from the ocean, it must have been in solution in the water as carbonic acid. If the carbonic acid and calcium, which form the carbonate of lime, were in solution i n the ocean, what was there to prevent their chemical combination in the water to form the limestone by direct action, and thus save the poor little coral makers millions of ages of toil?

Now let us suppose that there was a surplus of carbonic acid in the water after satisfying the cravings of the calcium and the formation of the vast beds of limestone. What next?

We find in the crust of the earth vast quantities of silica, and silicates of alumina. Now if these metallic bases, silicon and aluminium, were in solution in the acidulated water, they would readily combine with the oxygen of the carbonic acid, and come down as fire clay, and shales, to form a bed for the precipitate of carbon to fall upon, bringing down with it quantities of hydrocarbons to form the volatile portions of the coal.

If the water was badly agitated, this carbon would come down as a mixture with the mud, to form the slates above the limestone; but if in an inland sea where the waters were quiet, it would form layers of coal and shales.

The carbon to form the carbonic acid in the ocean, in all probability came from the interior of the earth, and was converted into carbonic acid gas by the same action and forces that cause earthquakes and volcanoes, and was injected into the ocean through the fissures below, under equal pressure. If this theory has the semblance of probability it is not unwise to look for coal in any portion of the earth's crust when the formations indicate the true coal series of conglomerate rock, limestone, fireclay, coal, shales; and the repitition of sandrocks, clays, coal and shales; so that an intelligent study of "the laws and causes most active in the formation of coal," is of no little value to the entire population of the world commercially.—Titus P. Emery, in Mining Review.

SCIENCE LEADS TO ECONOMY OF TIME AND LABOR.

How exultant is the old Greek poet Antipater ("Analecta Veterum Græcorum," Epig. 39, vol. ii., p. 119) when women are relieved of the drudgery of turning the grindstones for the daily supply of corn! "Women, you who have hitherto had to grind corn, let your arms rest for the future. It is no longer for you that the birds announce by their songs the dawn of the morning. Ceres has ordered the water nymphs to move the heavy millstones and perform your labor." Penelope had twelve slaves to grind corn for her small household. During the most prosperous time of Athens it was estimated that there were twenty slaves to each free citizen. Slaves are mere machines, and machines neither invent nor discover. The bondmen of the Jews, the helots of Sparta, the captive slaves of Rome, the serfs of Europe, and uneducated laborers of the present day, who are the slaves

of ignorance, have added nothing to human progress. But as natural forces substitute and become cheaper than slave labor, liberty follows advancing civilization. Machines require educated superintendence. One shoe factory in Boston by its machines does the work of 30,000 shoemakers in Paris, who have still to go through the weary drudgery of mechanical labor. The steam power of the world, during the last twenty years, has risen from 11½ million to 29 million horse power, or 152 per cent.

Let me take a single example of how even a petty manufacture improved by the teachings of science affects the comforts and enlarges the resources of mankind. When I was a boy, the only way of obtaining a light was by the tinder box, with its quadruple materials, flint and steel, burnt rags or tinder, and a sulphur match. If everything went well, if the box could be found and the air was dry, a light could be obtained in two minutes, but very often the time occupied was much longer, and the process became a great trial to the serenity of temper, The consequence of this was that a fire or a burning lamp was kept alight through the day. Old Gerard, in his Herbal, tells us how certain fungi were used to carry fire from one part of the country to the other. The tinder box long held its position as a great discovery in the arts. The pyxidicula igniaria of the Romans appears to have been much the same implement, though a little ruder than the flint and steel which Philip the Good put into the collar of the Golden Fleece in 1429 as the representation of high knowledge in the progress of the arts. It continued to pre vail till 1833, when phosphorus matches were introduced, though I have been amused to find that there are a few venerable ancients in London who still stick to the tinder box, and for whom a few shops keep a small supply. Phosphorus was no new discovery, for it had been obtained by an Arabian called Bechel in the eighth century. However, it was forgotten, and was rediscovered by Brandt, who made it out of very stinking materials in 1669.

Other discoveries had, however, to be made before it could be used for lucifer matches. The science of combustion was only developed on the discovery of oxygen a century later. Time had to elapse before chemical analysis showed the kind of bodies which could be added to phosphorus so as to make it ignite readily. So it was not till 1833 that matches became a partial success. Intolerably bad they then were, dangerously inflammable, horribly poisonous to the makers, and injurious to the lungs of the consumers. It required another discovery by Schrotter, in 1845, to change poisonous waxy into innocuous red-brick phosphorus, in order that these defects might be remedied, and to give us the safety match of the present day.

What have these successive discoveries in science done for the nation, in this single manufacture, by an economy of time? If before 1833 we had made the same demands for light that we now do, when we daily consume eight matches per head of the population, the tinder box could have supplied the demand, under the most favorable conditions, by an expenditure of one-quarter of an hour. The lucifer match supplies a light in 15 seconds on each occasion, or in 2 minutes for the whole day. Putting these differences into a year, the venerable ancient who still sticks to his tinder box would require to spend 90 hours yearly in the production of light, while the user of lucifer matches spends 12 hours; so that the latter has an economy of 70 hours yearly, or about 10 working days. Measured by cost of production at 1s. 6d. daily, the economy of time represented in money to our population is £26,000,000 annually. This is a curious instance of the manner in which science leads to economy of time and wealth even in a small manufacture.

In larger industries the economy of time and labor produced by the application of scientific discoveries is beyond all measurement. Thus the discovery of latent heat by Black led to the inventions of Watt, while that of the mechanical equivalent of heat by Joule has been the basis of the progressive improvements in the steam engine, which enable power to be obtained by a

consumption of fuel less than one-fourth the amount used twenty years ago. It may be that the engines of Watt and Stephenson will yield in their turn to more economical motors; still they have already expanded the wealth, resources, and even the territories of England more than all the battles fought by her soldiers or all the treaties negotiated by her diplomatists. The coal which has hitherto been the chief source of power probably represents the product of five or six million years during which the sun shone upon the plants of the carboniferous period, and stored up its energy in this convenient form. But we are using this conserved force wastefully and prodigally; for, although horse power in steam engines has so largely increased since 1864, two men only now produce what three men did at that date. It is only three hundred years since we became a manufacturing country. According to Professor Dewar, in less than two hundred years more the coal of this country will be wholly exhausted, and in half that time will be difficult to procure. Our not very distant descendants will have to face the problem —What will be the condition of England without coal? The answer to that question depends upon the intellectual development of the nation at that time. The value of the intellectual factor of production is continually increasing, while the values of raw material and fuel are lessening factors. It may be that when the dreaded time of exhausted fuel has arrived, its importation from other coal fields, such as those of New South Wales, will be so easy and cheap that the increased technical education of our opperatives may largely overbalance the disadvantages of increased cost in fuel. But this supposes that future governments in England will have more enlightened views as to the value of science than past governments have possessed.

Industrial applications are but the overflowing of science welling over from the fullness of its measure. Few would ask now, as was constantly done a few years ago. "What is the use of an abstract discovery in science?" Faraday once answered this question by another, "What is the use of a baby?" Yet round that baby center all the hopes and sentiments of his parents, and even the interests of the State, which interferes in its upbringing so as to insure its being a capable citizen. The processes of mind which produce a discovery or an invention are rarely associated in the same person, for while the discoverer seeks to explain causes and the relations of phenomena, the inventor aims at producing new effects, or at least of obtaining them in a novel and efficient way. In this the inventor may sometimes succeed without much knowledge of science, though his labors are infinitely more productive when he understands the causes of the effects which he desires to produce.—Sir Lyon Playfair's Aberdeen Address.

MISCELLANY.

THE GORTYNA TABLES.

The learned world was startled last Summer, by the discovery of a great inscription at Hagioi Deka, the site of the ancient Gortyna, in Crete. The inscription was in boustrophedon, using the eighteen so-called Cadmean letters, and presenting so many orthographic and dialectic peculiarities that its difficulties prevented its appearing in the popular periodicals. The inscription was discovered by Dr. Frederico Halbherr, in July, 1884, in the bed of a mill stream. Dr. Ernest Fabricius succeeded in unearthing the whole inscription by the end of October, 1884, and found it to be on the inside of the enclosing wall of a presumably circular building, whose inner diameter was about thirty-three meters, the wall being about nine meters long, and about the height of a man. The inscribed wall consists of four courses of squared stones, of

limestone. Dr. Halbherr subsequently found another loose fragment in the stream. The inscription, in its present state, consists of twelve columns, more or less perfect, and between fifty and sixty lines to the column. Other pieces turn out to have been previously found by other persons. The date of the inscription appears to be the fifth century before Christ. It was immediately seen that this inscription was a section of the famous Cretan laws; in all probability some of those which give more than heroic fame to Minos and Rhadamanthus. It was not possible to obtain sqeezes; but Halbherr and Fabricius made careful copies, and attempts at decipherment immediately followed. The chief, and apparently the first works on the subject, were the following: Dareste, "La Loi de Gortyne," in Bulletin de Correspondence Hellenique, 1885, pp. 301—317; Heinrich Lewy. "Aites Stadtrecht von Gortyn auf Kreta." Berlin, 1885, Franz Bucheler und Ernst Zitelmann, "Das Reeht von Gortyn," Khetnisches Museum Erganzungsheft XL; Domenico Comparetti. Leggi antiche della gita gi Gortina in Creta," Florence, 1885. Prof. A. S. Merriam also read a paper on the subject at the meeting of the American Philological Association in New Haven, last July. But the most self-commending publication thus far, is the very recent one of Johannes and Theodor Baunack, entitled "Die Inschrif von Gortyn," published by S. Hirzal, of Leipzig; an 8vo volume of 167 pages, with a fac simile plate. The decipherment, or rather, the solution of the orthographical, dialectric, and lexical puzzles, appears to be so far advanced that the inscription may be said to be read, and the laws to be fairly understood. The work of the Baunacks treats first of the alphabet, then gives the inscription in ordinary type, with the numberings of the original in capitals, with transcriber's variants in the lower margin. Then follows the grammatical matter deduced from the inscription, occupying the largest portion of the work; then the inscription divided into words accented and punctuated, with a translation in German, occupying 24 pages. then the lexical and exegetical matter, and a complete word-index. The contributions of the inscription to Greek lexicography and palæography are very great, and cannot be overvalued; but the matter of the law is of general interest, although they deal with many matters which Christianity has rendered well-nigh obsolete among civilized nations. The first section treats of lawsuits for the possession of an alleged slave. The alleged slave is not to be spirited away till the cause is decided, under a penalty to be paid by the litigant so doing. The law provides, in brief sentences, for the case when the alleged slave is proved to be free, when he is proved a slave and his posession is due to either litigant, and so on; and also for the various contingencies that may occur during trial. The second section provides for seduction, adultery, and the like; the third for division of the property in case of separation of man and wife, or the death of one of them; the fourth for the custody of children of separated wives or concubines; the fifth, provisions respecting the property of parents during life, and its disposition after their death; the sixth, of the limits of control over the property of members of the same family; the seventh, of certain peculiar cases in the law respecting slaves and children; the eighth, concerning the rights and duties of heiresses; the ninth, concerning sundry cases of suretyships; the tenth, concerning presents; the eleventh, of adoption, and its concomitants; the twelfth, supplementary matter to the preceeding. The provisions that relate to slaves, as might be supposed, breathe the spirit of all antiquity, which recognized nothing at all in the slave except the property of the master. With respect to separations of man and wife, since those are part of the institutions of almost all humanity outside of Christendom, there are a few lessons which might be taken to heart by those legislators who favor easy divorce. Thus:

"When man and wife are separated, she shall have, as her own property, that which she brought to her husband, and half of the increase, if any such has come from her own estate, and half of all that she has

gained in the house [of her husband]; and five staters if the husband is to blame for the separation. But if the man alleges that he is not to blame for the separation, the judge shall decide between them, upon oath."

So again:

"If a separated woman comes back, the child shall be brought to his house in the presence of three witnesses. If he does not receive it, then the mother shall have power over the child, to rear it or to expose it; but the relatives shall first have a right to her oath and witnesses, whether she offered it [to her husband or not]."

In the case of a divorced female slave, who comes back with the child, the husband's master was to have the full decision; and that, also, even if she had re-married the same man within a year. If a separated wife should expose a child before complying with the foregoing provisions, then she had to pay a fine of fifty staters if the child were free, but twenty-five if a slave. In general, the laws show the spirit of equity, as nearly as we can perceive from our present knowledge of Cretan society. Today, of course, we are scarcely able to see the justice of compelling an heiress to marry her oldest male cousin, or if he is not willing, or if he is not grown up and she will not wait, lose a large portion of her heritage. However, an heiress was one who had no father or brother. She might also, in case the cousin would not or could not marry her for other reasons, marry whom she would and retain her whole inheritance. Adoptions might be made at pleasure, but it must be publicly done in the agora, before the assembly of citizens at the usual place of proclamation; but the one adopting a son had to give his "Hetaireia" material for a sacred offering, and a jar of wine. If an adopted son is the only child surviving the one who adopted him, he becomes full heir only on condition of performing all the religious and legal duties to his adoptive parent; but if he in turn died without leaving children, the property reverted to the relatives of the adoptive parent. The latter might, also, at any time, publicly annul the adoption by a proper proclamation and paying a fixed number of staters. An English translation of these laws, or better, an edition of the inscription edited and translated in English, is a work now much to be desired.—Exchange.

A SLAVE TO THE STARS.

An attempt is made to break the very eccentric will of Robert Treat Paine, a wealthy Bostonian who died last June. Mr. Paine was always regarded as a sort of crank during his life. For example, he paid over $1,000 in fines for stubbornly persisting in not clearing the snow off his sidewalk.

Regarding astronomical matters he was always thought to be half insane. When he died it was found by the terms of his will $50,000 was bequeathed to the president and fellows of Harvard college, or more if they deemed it necessary for the maintenance and support of a professorship at Harvard, to be called the professorship of practical astronomy, the holder of the same to be the director of the astronomical department. In commemoration of the great-grandfather, grandfather and father or the deceased, it is the wish of the testator that the professorship be called the Paine professorship.

All the residue of the property and estate is bequeathed to the president and fellows of Harvard for the support of the observatory, for the discovery of new comets, and planets, and for the purchase of medals for prizes for valuable essays written on astronomy, provided that the president and fellows pay monthly out of the fund $250 to the widow, Ann W. Paine, upon her written order.

The will was approved, but several appeals have been filed objecting to the decree of the probate court in allowing the will. The widow files an appeal in which she claims that her husband was not of sound mind when he made the will; that the witnesses did not sign it in the presence of the testator, or of each other: that undue influence was brought to bear on the mind of the testator, and that the instrument as

made was afterward revoked. Elizabeth P. Patch and Charles W. and Henry M. Claggett, all of Boston, heirs at law of the deceased, have also taken appeals to the allowing of the will upon the ground that they are interested in the estate. The case when heard will be one of great interest, and some remarkable testimony regarding Mr. Paine's eccentricities will be given.

VISIT TO A SHOT TOWER.

Shot is formed by pouring a melted piece of alloy of lead through a colander or sieve at the top of a high tower. In falling to the base of the tower the particles of semi-fluid lead assume the globular form. They fall into a vessel of water placed to receive them, before reaching which they become so nearly solid that their globular form is retained when they strike the surface of the yielding element. An arsenical preparation forms the alloy, which makes the lead more ductile, softer and better fitted to take the spherical form. The soft and pure American lead requires less arsenic than the hard and brittle foreign varieties. Too much arsenic causes the drops to assume the lenticular form, and too little, causes them to elongate, to flatten on one side and hollow in the middle as they cool. The higher the tower the larger the shot that may be dropped in it. I had an opportunity at Chicago of inspecting the whole process of making shot. Also at the same time I saw how sheet lead and lead pipes are manufactured, and the no less interesting processes in the manufacture of linseed oil.

The lofty tower, as high and almost as massive as Bunker Hill monument, must have attracted the attention of nearly every one who has visited the city. From its summit the best view of the city is to be obtained. It is one of the tallest towers erected for this purpose in the world. There is one in Europe two hundred and forty feet high. Some of the perpendicular bluffs on the upper Mississippi, in the vicinity of the lead mines of Iowa and Wisconsin, are used in the place of towers, the melted lead being dropped over the precipices.

The shot are of larger dimensions than the holes of the colander through which they pass. Mr. Blatchford dipped out a handful from the cistern for our inspection. There were quite a variety of sizes, and many of the drops had assumed irregular forms. The first done with the shot is to dry them, and then the perfectly spherical ones are selected by a very ingenious contrivance, as simple as it is ingenious. A series of inclined planes is so arranged, one below another, with gaps between, that when the shot is poured upon the top one, the perfectly spherical ones of all sizes, bound forward merrily in straight lines, skipping the gaps unerringly, and flying off neither to the right hand nor left. Anyone who has tried to roll an imperfect ball in a tenpin alley, knows what an irresistible attraction the sides of the alley have for that poor ball. It will not keep upon the straight highway cast up for it, but must needs roll into the ditch, a melancholy instance of the "depravity of inanimate things." So the imperfect shot scatter out at the sides of these planes. And even if they chance, by a miracle of grace, to keep in the center, they drop into the cunning pitfalls over which their perfect brethren nimbly skip in safety. The nearly perfect ones sometimes escape several of these gaps, but are all caught before they reach the bottom, and, self-convicted, are unceremoniously returned to the melting pot. The perfect ones of all sizes run into a revolving barrel, where with a little pulverized graphite, or plumbago, they roll about for a while, and acquire the brilliant polish which is their finishing touch.

It only needs now to assort the sizes and to pack them in the little canvas bags familiar to all sportsmen. They are sorted in revolving cylinders slightly inclined, perforated with holes, which increase in size toward the lower end. Each size drops out as soon as it comes to a set of holes large enough to allow the shot to pass. The arrangement for weighing and bagging them is very ingenious. Receptacles numbered from one to twelve, according to the size of the shot, under the revolving cylinders,

conduct the little death-dealing missiles through tunnels into the canvas bags. As soon as a bag has received its twenty-five pounds its weight shuts a valve, and no more can come till the bag is removed, and another one put into its place. One man tends the whole row, with needle and thread sewing up the bags, which are then ready for the market. All the work of the tower, except that which is done by machinery, is performed by three men.—Exchange.

SOME OLDEN TIME PECULIARITIES OF MEN'S DRESS.

There is no part of mens' costume which has not passed from one extreme of absurdity to another, and been most admired at its highest point. Coats have been worn with voluminous skirts dangling about the wearer's heels and with scanty lappels descending six inches below the waist. Coat-sleeves at one time fitted skin tight, and more than once have been so wide as to sweep the ground.

Flapped waistcoats, which in the time of George I, reached nearly to the stocking, were soon cut so short as to be nearer the armpits than the thigh. The tight fitting, closely-strapped trouser contrasts ludicrously enough with the trunk hose of the sixteenth century stuck out with five or six pounds of bran.

It is related that a fast man of that time on rising to conclude a visit of ceremony had the misfortune to damage his nether integuments by a protruding nail in his chair, so that by the time he gained the door the escape of bran was so rapid as to cause a collapse. It may have been that similar mishaps caused the substitution of wool or hair for bran, which afterwards became common.

Holmes, in his "Notes on Dress," says: "A law was made against such as did stuff their 'bryches' to make them stand out; whereas, when a certain prisoner (in these tymes) was accused for wearing such bryches contrary to law, he began to excuse himself of the offense, and endeavored by little and little to discharge himself of that which he did wear within them. He drew out a pair of sheets, two table-cloths, ten knapkins, four nightcaps and other things of use, saying, 'Your Lordship may understand that because I have no safer storehouse, these pockets do serve me for a roome to lay my goods in, and though it be a strait prison, yet it is a storehouse, big enough for them, for I have many things more, yet, of great value within them.' And so his discharge was accepted and well laughed at."

CURRENT LITERATURE.

Political Economy.

PRACTICAL ECONOMIES: A COLLECTION OF ESSAYS RESPECTING CERTAIN OF THE RECENT ECONOMIC EXPERIENCES OF THE UNITED STATES. By David A. Wells, LL. D., D. C. L., etc. New York and London: G. P. Putnam's Sons, The Knickerbocker Press, 1885.

This book is a compilation of papers from the pen of the distinguished author, which have appeared, from time to time, in various periodicals and newspapers. It would be supererogatory to enter into a discussion of Mr. Wells' ability and learning in respect to the subject matter of these papers, for he has long been an oracle to free-traders, monometalists and conservative economists. In fact his celebrity has been chiefly obtained as a publicist, and it would be impossible for any one to gain such a prestige without manifesting great merit and ability in his performances.

The papers comprised in the volume all touch on living questions in finance, commerce and social statics. And, while these subjects are discussed in a partizan spirit, and the errors of opposing schools exposed with great vigor, still the skill of the writer, his keen and trenchant logic and ready wit, keeps the reader interested in spite of antagonistic views.

Mr. Wells writes with the candor of conviction. No one can read the above volume without believing that his opinions, however erroneous or

specious, are honest ones, and founded on experience in affairs and thorough acquaintance with the past and the present of the world's history. Those who wish to see both sides of the shield (and have only seen the silver side) should turn to Mr. Wells' book for aid.

Natural History.

THE STANDARD NATURAL HISTORY. Edited by John Sterling Kingley. Vol. V., Mammals. Illustrated. Boston: S. E. Cassino and Company, 1884. Kansas City: C. E. Hudson & Co.

This is Volume V. of a work of which Volumes I. and II. were noticed some time ago in the REVIEW. The intervening volumes (III. and IV) have been delayed, we are told, by the binder, but will be forthcoming before Christmas.

The present volume comprises an account of the Mammalian family, and embodies the work of such specialists as Dr. Cones, Dr. Theo. Gill, J. S. Kingsley, W. N. Lockington, Samuel Lockwood, George Macloskie, Wm. B. Scott and R. R. Wright. It begins with a very useful and lucid introduction, which serves as a key by which the merest tyro can read what follows with pleasure and profit. The illustrations are new and excellent, being faithful representations of animal life. The "Standard Natural History" is destined to be the leading popular work on the subject of animated nature; and if the opinions of eminent scientists carry any weight, it is equally as useful to the student as to the general reader.

It is especially valuable to the young. Children and youths will read such a work with the avidity they would a novel, and the benefit they would derive from it cannot be compared to that derived from any other class of literature.

History.

HISTORY OF THE PACIFIC STATES OF NORTH AMERICA. By Hubert Howe Bancroft. Vol. XV., California. Vol. III., 1825–1840. San Francisco: A. L. Bancroft and Company, 1885.

Mr. H. H. Bancroft is performing a service for the Pacific coast unprecedented in former literary adventure. If the Atlantic States and the Mississippi Valley could have had their annals written in the full and generous method Mr. Bancroft has adopted, the results would have justified even the lavish expenditure and labor bestowed on the Pacific States History. It is true we have had a Schoolcraft, a Gallatin, a Parkman, an Irving, a George Bancroft, and many other eminent ethnological and historical writers: but their labors have not all been directed toward definite ends, and they have been too much hampered by the supposed necessity for balanced sentences and cadenced words. To tell the truth an artificial literary style is least needed in historical writings; for it always seems to be leading the attention from the facts and events narrated, to the ostentatious author.

The volume before us tells in good terse English, the story of an epoch as romantic and adventurous as any in history. In the two preceding volumes of Californian chronicles, the narrative of discovery and colonization has been brought down to 1825. Then commenced the stirring for independence which was to bring about civil war (not very sanguinary, however), between northern and southern California. The story of the skirmishes, the bickering, the diplomacy and intrigue characteristic of the time is well told. This history has one source of great interest to old Californians. In each volume there is carried along an alphabetical pioneer register—giving a short biography of the immigrants who arrived in California from 1542 to 1848. This must have required an immense amount of labor in its compilation. No one can be said to be familiar with Californian history who has failed to read Bancroft's volumes.

Reference Books.

INDEXES TO THE ENCYCLOPÆDIA BRITANNICA, Ninth Edition. American Reprint. Philadelphia: J. M. Stoddart Co. Limited. 1884.

Those who have had occasion to consult the Encyclopædia Britannica can appreciate the value of an index which will direct him to the matter, and the matter alone, he wishes to refer to. While this great work stands unrivalled in its special field, there has always been a serious difficulty in the way of its popular use. In other similar works the arrangement of matter is more after the manner of a lexicon, and cross-references help the seeker after knowledge on his way; but in the Britannica, matter that might be distributed under fifty heads is put in under Astronomy, Botany, Geology, Mathematics, Palæontology or some such captions to the dismay of the hurried and the despair of the lazy. This Index furnishes just what is needed to overcome these difficulties. Upon an examination we find it thoroughly reliable and extremely useful.

Poetry.

UTOPIAN DREAMS AND LOTUS LEAVES. By George W. Warder. London: Sampson Low, Marston, Searle & Rivington. 1885.

It is the special mission of the REVIEW to encourage the growth of Literature in the West, and therefore it is with great pleasure it calls attention to the sheaf of poetry entitled above.

Mr. Warder has been so long considered the Bard of Kansas City, that we should feel quite startled to read Another's lyrical characterization of local or visiting celebrities.

In the volume before us there is quite a wide range of subjects to choose from; and it seems improbable that there could be any one entirely unsuited. He flies from "grave to gay from lively to severe," with the rapidity of thought and, like Puck, puts a girdle round the earth in "forty minutes," or thereabouts. So facile is our author, so unhampered by space, or time, or conventionalities, that he keeps his reader in a constant fever of anxiety as to his next flight. In this Mr. Warder can justly lay claim to great originality; for no one can deny that the introduction of a new principle into literary style is an achievement accomplished by but few, and when this principle is founded upon a characteristic of human nature so fleeting as the charm of uncertainty, it may easily be seen that genius, and genius alone, could have discovered and utilized it.

There it one fault we must find with Mr. Warder's poetry—it is a little fault and can easily be remedied. There is too much compresion, too much attention to the matter rather than the form. Mr. Warder is not a florid writer. Now and then, it is true, he forgets reserve, flings prudence to the winds, mounts the most skittish Pegasus that can be captured in all Castalia, and, riding amuck at the startled moon, scatters flowers, jewels, diadems, over the hushed universe. But these moments of poetic fervor are all too rare; his sober muse is rarely "Empress of the raging storm."

Without wishing to be hypercritical, there is one other fault to be found with our Bard. Occasionally he slyly indulges an ironical mood, which is most unexpected in the Minstrel of Eden Dell. It was Byron, I think, that contemned blank verse as "prose run mad." Mr. Warder has seen fit to adopt the same view, apparently, and in a humorous moment has travestied that form of poetry in a piece entitled "What Causes Poetry." This opens as follows:

"This causes poetry. 'Tis the first effort of the
Mind to soar into fair fields of glowing fancy;
To lift itself into high channels of bright thought;
To perceptions lofty and enthusiastic of the
Grand and beautiful, to struggle up to
Greater light, to something better and more
noble
Than the groveling and material things
That make the routine of each passing hour."

In the words of Mr. Pecksniff, "it was not well" in Mr. Warder to thus rudely travesty a form of verse so sublimely used by Milton, so exquisitely refined by Tennyson.

The frontispiece does scant justice to Mr. Warder's face. We assure the stranger fair ones who read his book (and we hope they will be legion) that he is a much handsomer man than the graver makes him to be.

Other Publications.

Natural Gas; Its Advantages, Use, Supply and Economies. By George H. Thurston. Pittsburgh: A. A. Anderson & Son, 1885; pp. 31.

Bullettin of the Washburn College Laboratory of Natural History. Francis W. Cragin. Topeka: R. E. Martin & Co. 1885. Price 20 cents.

Le Taensa a t' il ete Forge de Tontes Pieces? Response a M. Daniel G. Brinton, A. M., M. D. Par Lucien Adam. Paris: Maisoneuve Freres et Ch. LeClerc. 1885.

Dom Parisot, ne Produira pas Le Manuscrit Taensa. Lettre a M. Victor Henry. Paris: Maisoneuve Freres et Ch. LeClerc. 1885.

Le Taensa n'a pas ete Forge de Tontes Pieces. Lettre de M. Friedrich Mueller a Lucien Adam. Paris: Maisoneuve Freres et Ch. LeClerc. 1885.

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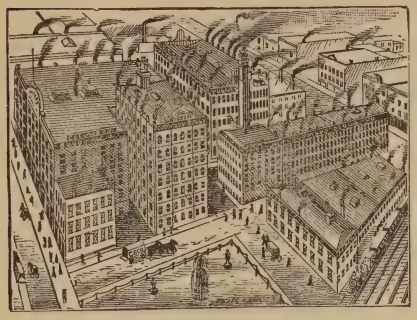
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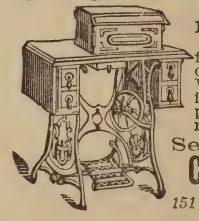












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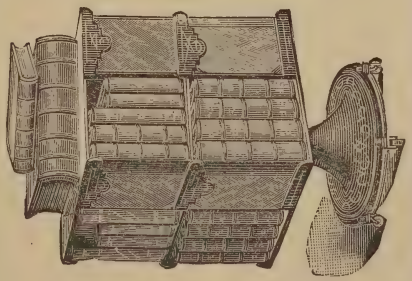
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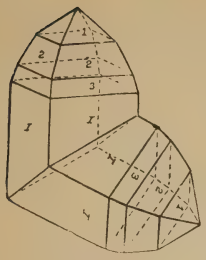
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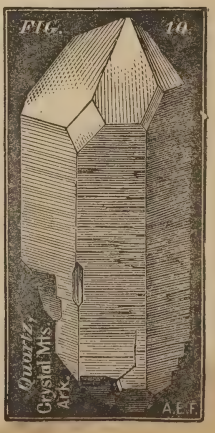
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CONTENTS:

PAGES.

The Theory and Development of Electro-Magnetism. JOHN C. HENRY....275
Atmospheric Tides. C. A. SHAW.....279
Shakespeare's Childhood. W. W.....283
The Achievements of Mechanical Engineering. I. P. HOLLOWAY.....290
Gold Mines and Mining in California. HENRY DEGROOT.....298
The Esquimaux. LIEUT. FREDERICK SCHWATKA.....303
The Streams of Western Kansas. PROF. E. O. POPENOE.....308
Pneumonia and Ozone. PROF. DANIEL DRAPER.....311
Concerning Clubs. MRS. LAURA E. SCAMMON.....313

EDITORIAL: Contemporary Fiction—A Critic Criticized—A Few Observations—Nota Bene, Etc 321
CORRESPONDENCE: Mr. Koun's Criticism..... 326
SCIENTIFIC AND INDUSTRIAL NOTES: The Kansas Academy of Science—Molds—Visit to Mines of Unknown Period in the Serro de Las Canas—Anthropology—The Davenport Elephant Pipes—The Silver Question—The Philosophy of Vaccination—The Pyrophore—Monster Sea-Turtle Found in Kansas—Diffusion Process of Extracting Beet Sugar—A Suggestion That May Prove of Value—A Huge Bridge—The Kinetic Theory of Gases—Getting the Taste of Mutton—Coins as Disease Disseminators—Red and Purple Ribbons Suppressed—Gold Under Philadelphia—How Old Sol Used to Shine—Ancient Rivers—The Toronto Electric Railway—A Pedagogue in Kansas—Compressed Air Street Cars—Science and the Government—A Litter of Babies—Insects as Food—New Application of Iron—Tornado Predictions—A New Gold-Like Alloy—Weight of Coin—Spontaneous Combustion from Coal-Dust—Transporting Natural Gas..... 327
MISCELLANY: A Cylindrical Jail—Imagination and Dying—The Law of Finding—Commercial Relics of Ancient Rome—Remarkable Dreams—Lincolnshire Dialect—Turquoise..... 341

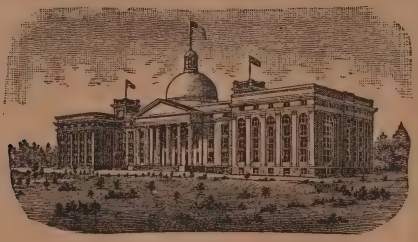
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WARREN BREWER WATSON,
THEODORE S. CASE, M. D., } EDITORS.

INDEX.

PAGE.

An Arizona Natural Bridge ... 27
Aspects of the Planets for August ... 38
A Chinese Columbus ... 88, 212
A Fish Eating Plant ... 105
American Association for the Advancement of Science ... 164
A First Prize Essay on Disinfectants ... 175
Atmospheric Tides ... 279
Achievements of Mechanical Engineering ... 291

Bacteria ... 102

Correspondence ... 50, 113, 184, 326
Current Literature ... 61, 133, 208, 271
Cradle of the Human Race at the North Pole ... 169
Concerning Clubs ... 313

Dickens and Thackeray ... 243

Electric Railways ... 25
Editorial ... 46, 111, 181, 253, 321
Early Stages in the Earth's Growth ... 77
Evolution in the Orchard ... 222
Esquimaux, (The ... 303

Fish-Eating Plant, (A) ... 105
French Academy (The) in its Origin ... 98

Gold Mines and Mining in California ... 298

History of Aryan Languages ... 143
Herbert Spencer's Essay on Religion ... 150, 216
Hypnotism ... 160

Intellectual Love ... 5
Industrial Achievements of the Ancients ... 11
Items from the Periodicals ... 53

Khetshua Language (The) ... 227

Life in Death ... 83
Life in Unconsciousness ... 156

Moral Microbes ... 19
Meteorological Notes ... 43, 44, 45
Miscellany ... 56, 126, 198, 267, 341

Native American Dogs ... 239

Our Consular Service ... 106

Primitive Gods (The) ... 15
Progress in Electric Railways ... 230
Pre-Historic America ... 236
Pneumonia and Ozone ... 311

Quest (The) for the Primeval Eden ... 36

Relations (The) of History to Archæology ... 1
Relics in a Cave ... 21
Round of Life, (The) ... 28

Storage Batteries for Motors ... 23
Some of the Wonderful Productions of the Sea ... 96
Stonehenge and Avebury ... 139
Song-Notes (The) of the Periodical Cicada ... 173
Scientific and Industrial Notes ... 59, 115, 185, 255, 327
Shakespeare's Childhood ... 283
Streams (The) of Western Kansas ... 308
Theory and Development (The) of Electro-Magnetism ... 276

Weather Report ... 45, 108

Zoological Enigmas ... 31

THE KANSAS CITY REVIEW,

DEVOTED TO

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VOL. IX. DECEMBER, 1885. NO. 5.

THE THEORY AND DEVELOPMENT OF ELECTRO-MAGNETISM.

This article is not intended as a technical essay on the subject treated, but rather as an attempt to give some simple explanations of what is generally considered a mysterious force, and a concise history of its development.

Galeazza, in honor of whom the first electric car operated in the West is named, was the family name of the wife of Galvani. To her the credit is given for first bringing to notice the fundamental principles of Electro-Magnetism.

In 1831, Prof. Faraday discovered that by moving a wire to or from a magnet, a current of electricity appeared, or was induced, in the wire.

What Electricity is, we do not know. A wire through which a current is traveling is nowise altered in appearance, yet its presence can be easily demonstrated.

According to the modern theories, Electricity, like heat and light, is a form of motion, and is convertible into other natural forces at will. Thus, heat produces electricity; electricity magnetism; magnetism force, and force, heat.

The creation of Static Electricity by friction dates back too far to trace, and has never been of any particular advantage in the arts. Franklin, in his well known experiment of the kite and thunder-cloud, first proved lightning to be identical with it.

Volta's pile, was, however, probably the first arrangement, or battery, ever constructed, which was capable of giving out a constant, steady current of electricity. His discovery of this principle seems to have been, like so many other discoveries which have been of the greatest importance to the world, the result of an acci-

dent. Having placed a small piece of copper on his tongue and a piece of zinc under it, Volta noticed a peculiar metallic taste when the edges of the metals came in contact, and its absence when they were separated. Quick to take advantage of every idea which suggested itself to him in the line of investigations he was pursuing, he constructed his so called "pile," composed of alternate layers of zinc, damp cloth, and copper, and thus was brought forth the first electric battery—since known as Volta's Pile; here was the first constant source of electricity.

The Galeazzi story runs something like this: "One day, Galvani, her husband, was experimenting with a voltaic pile. She noticed that when the wires leading therefrom approached some frog's legs which she was preparing for dinner, a peculiar spasmodic muscular movement occurred, causing a twitching or jerking movement of the same, and thereupon she called the attention of her husband to this seemingly strange phenomenon.

A closer observation of this fact and additional experiments, indicated to Galvani that the Magnetic forces with which the wire was endowed did not reside in the wire itself, but in the space surrounding it.

Acting upon this reasoning, Prof. Joseph Henry, of the Smithsonian Institute, in 1831, constructed the first horse-shoe magnet, which made telegraphy, telephony, and in fact, all of the arts in which Electro-Magnetism is now used, possible. Like Faraday, he displayed the true spirit of the scientist, and was more anxious to discover new facts in Magnetism than to exalt the value of those obtained, "being assured that the latter would find their development hereafter." Thus were important discoveries given to the world, to be afterwards developed into ideas and inventions, which have revolutionized the arts and sciences, as well as the commerce of the world.

In tracing the development of Dynamic Electricity we begin with Faraday. Up to the date of his discoveries, two other means of producing electricity had been known, viz: friction, and the decomposition of metals. But while these methods were available for the generation of light currents such as those required in the transmission of signals, they were altogether too expensive for the production of heavy forces. A voltaic battery that generates electric currents by dissolving zinc with sulphuric acid is an expensive source of power indeed; the zinc (the fuel of the battery) costing more than twenty times as much as coal, and, at the same time only evolving about one-sixth as much heat; leaving out of consideration altogether the expense of the acid.

In 1831, Prof. Henry developed and described the first Electro-Magnetic Motor. This was subsequently modified by different inventors and numerous attempts were made to propel boats and cars by this means, but such attempts all failed financially.

Had Faraday's discovery been developed as promptly as Henry's, the world, to-day, would have known much less of steam locomotion. It slumbered, however, for nearly thirty years; when the subject received a new impetus by the inventions of Pacinnotte and Gramme.

In 1860, Dr. Pacinnotte described in an Italian journal the first dynamo-electric machine; *i e*, a lot of bundles of wire revolving before the face of magnets, with suitable connections. This machine, planned in accordance with the principles laid down by Faraday, when put in motion by an external force induced a powerful current of electricity. The most remarkable feature, however, of this machine was plainly pointed out by its inventor. He found that it was reversible; that is that by applying power to it it produced electricity, or by applying electricity it produced motion or power.

Strange to say this most important discovery passed unnoticed for ten years, when Gramme, of France, re-invented the same apparatus. All practical dynamo electric machines and motors of to-day, are but modifications of the Gramme machine.

These discoveries, as I have said, at once gave a great impetus to the investigation of electric locomotion and lighting. The problem of cheap production of powerful currents of electricity was felt to be nearly solved. Subsequent improvements and modifications rendered this belief a certainty. Suddenly, and on all sides, there was the greatest activity shown in applying and adapting this new force, (new, because for the first time, practical) to the various necessities of civilization. From an expensive and experimental toy, the electric light sprang at once into common and practical use. So cheaply can currents be produced and converted into light that it is now said by excellent authority that 90 per cent. of the energy of the steam engine can be returned into light, by means of the perfect dynamo machines now constructed; a result which would have been hailed with absolute incredulity by the scientists of less than forty years ago. So much has electrical science advanced. Indeed, it is claimed by some of the motor makers that their machines give a proportionate return.

Electrical engineers have done their work much better than steam engineers, but much yet remains to be accomplished. When, in the future, another Faraday unlocks the hidden mysteries of nature and unfolds to us a method whereby the energy stored in fuel may be changed direct to electricity, then, and not until then, will the age of steam pass away.

The laws governing electricity are as well known and immutable as those of gravitation. We know that it falls to the earth on the line of the least resistance, and that it can be confined in conductors which offer less resistance than the adjacent elements. In winding Dynamos with coarse

wire we get a current large in volume, which requires large conductors, but low in intensity; on the contrary, in winding them with small wires small quantity, with great tension (or power of overcoming resistance) is obtained. The former is such as is used in Incandescent Electric Lighting, and is considered harmless. The latter, which is the current used in Arc Lighting (the system in use in this city (is of a more volatile nature and is highly dangerous.

The writer does not know where the dividing line between Static and Low Tension Currents of Electricity, lies. Frictional machines have been made large enough to discharge a spark through the air to a point eighteen inches distant.

The development of Dynamo Machines has necessitated the adoption of standard rules of measurement. A volt meter indicates the tension of a current, whilst the quantity is measured by the ampere meter. A convenient rule for finding the mechani cal horse-power of a current is to multiply the number of Volts and Amperes together, and divide by 746.

What constitutes a safe current is hard to determine. A thin-skinned moist-handed person would be killed by handling wires carrying a current of one thousand volts, while a dry, horny-handed person would not notice the same contact.

Although I have spoken of electricity as being generated from steam power, yet water power is a good equivalent. From a calculation which I made sometime ago, I became convinced that the force quietly going to waste in the Kaw River is sufficient to move all the railroad trains in the states of Kansas and Colorado.

This reminds me that I was to add something concerning Eletric Railroads, and more particularly concerning my developments of the system substituting electric motors for animals. Animal power, compared with steam power is very expensive, and compared with the power derived from electric motors is still more so. It is a fact well known to engineers that the best locomotives, in point of enconomy, are very imperfect and wasteful machines, and it is necessary that they should be such. They must use a large percentage of their energy in auxillary devices. They are compelled to use force-blast, which is a fuel wasting affair. They cannot avoid leaving a track of heat and carbon as they pass through the country. The best locomotives built consume seven pounds of coal to the horse-power developed per hour (many use 15 pounds) while stationary engines are getting common which use less than two pounds. In my system of Electric Railroads stationary engines are used to run a dynamo-electric machine, whose current travels on conductors placed above and near the track. A traveling carriage connected by a wire with the motor on the car, rides on this conductor which is over the track,

and is pulled along by the motion of the car. Thus we get a constant current transmitted to the motor on the car itself, which is exactly similar to the one at the engine house which generates the current. By remembering the description of Dr. Pacinotte's discovery of the reversibility of the dynamo, the reader can readily see that the electric current generated by the dynamo at the engine house, will turn the motor on the car at a high speed. The rest is simple. To connect the motor with the car axles, so as to transmit the force to them, is a question of every day mechanics, with a description of which it is not worth while to trouble the reader. But this is not all. When the car is forced down hill by gravity, the arrangement is such that the momentum of the car turns the motor on board of the same, and causes it, in turn, to produce a current of electricity which is utilized to assist other cars up the grades. Thus as littls as possible of the energy is wasted, and, in fact, I believe that our system returns more of the energy into motion than any other. This is but saying, in effect, that it is cheaper than any other means of street locomotion. This we have demonstrated. The results of our experiments, carried on during the past twelve months, are very satisfactory, and there can no longer be any doubt that, in a very short time, electricity will take the place of animals and cables in propelling street and elevated cars.

ATMOSPHERIC TIDES.

As the month of October is, for many reasons, a typical one, it may not be without interest to examine, somewhat in detail, the phenomena which the United States weather maps so graphically picture forth.

The theories in regard to areas of low and high barometer and their tracks are continually undergoing modification. They are very different from what they were five years ago. They have materially changed within two years. In early days a systematic charting of each separate "low" was undertaken. It was believed that by such minute observations a definite track could be determined. This has been productive of excellent results. Beyond such empirical success lies, however, a region of true scientific deduction, that has yet hardly been approached.

The weather map includes the portion of North America lying between the meridians of 20 east of Washington to 50 west and the parallels of latitude 20 to 50. Roughly it is about 3,000 miles east and west by 1,800 north and south. It is too limited for a proper representation of our weather system, but is even now beyond the limits of the means at the

disposal of the signal office to adequately fill out with stations.

The earth at the northern line of this map has a much sharper curve than at the southern line. We may compare it to the shape of a jug towards the neck. We may suppose the tendency of the line of low barometer towards the northeast as exemplifying the same law which would make a string slip towards the neck of a jug if drawn around it and tightened.

Meteorology is easily divisible into climatology and the "law of storm." To the former, tables of mean pressure, temperature, wind direction, rainfall, etc., belong. They are valuable even as tables of life, statistics of production and the like are for special professions. The "law of storms" deals with the atmosphere as a whole or over some portion of the globe of considerable extent; in the present case, the region in and about the United States, as before indicated.

On the first day of October of this year there was upon the weather map a roundish space of about 800 miles in diameter near the upper left hand corner, or northwest quarter, marked "high" and quoted as showing a pressure of 30.20 inches. About a thousand miles to the southeast, somewhere near the Ohio valley, was a smaller but irregular oval, some 700 by 100 miles in area, the longest diameter lying in the same direction, viz: southeast and northwest. It was marked "low," with a pressure of 29.80. It may be unnecessary to state that a difference of four-tenths of an inch in pressure between areas so far apart is not likely to produce any serious disturbance. The actual difference in tons can be easily enough calculated, difference in area also considered, but divided by a thousand miles it would not give a high ratio of local pressure.

From what we know by previous observations, we can formulate a few general laws by which the progress of this area of low barometer may be foretold. Usually the direction is northeasterly, at first of moderate and then of accelerated speed. Cloudy weather will usually be its accompaniment, with possible rain along a certain line. This, over a certain district, with east to southerly winds upon one side, and north to northwest on the other. Warmer followed by cooler temperature, as in the stereotyped formula. To do more than this, we must enter into a region of speculation, and theorize a little boldly. The defect of our weather map is that it covers too limited a field. Looking at the map and seeing the relative positions of the two areas charted, and their direction from each other, we might guess that, as when there is a valley at the foot of one hill another hill is on the other side, so an area of "low" implies areas of "high" upon both sides. Since the "low" is a thousand miles, southeast of the "high" in this case, we may conclude that southeast of this a thousand miles or so is the op-

posing high. It might be farther or less, since the gradient is frequently steeper on one side than the other (and this is an excellent means of calculating the probable direction), but that it exists is almost self-evident. We may satisfy ourselves that it is there in this case by glancing two or three days ahead, say to October 4th, when a well-defined area of high is charted off the Carolina coast. It is almost too well defined upon its seaward side, since no reports could have come from there, but that is a minor inaccuracy.

We wish then to insist upon the fact that this area of "low" lies between two antagonistic areas of "high" that probably the southern area is the largest, that it "outflanks" the northern, so to speak, and that the "jug-neck" shape of the earth conduces to the constantly slipping northeasterly of the low barometer track.

On Oct. 2d, the area of "low" had moved a little to the north and was not very well defined, but began to get squeezed into more marked existence on Oct. 3d, then over the lower lakes with a pressure of 29.60. On the 4th, it was 29 40, its area very much circumscribed and by the 5th, is off our maps at the upper right hand corner. Evidently like the vortexes we see formed in running water there is a tendency to increase of local depth with limits of area. If we go back to the last week in September we can trace this area from the Gulf of Mexico, gradually increasing in definiteness and going off in a swirl like a snapper of a whip.

On October 6th, an area of "high" was near the center of our maps; 30.10 was the pressure. It was of enormous extent, shading off gradually upon all sides. Cool and clear weather generally prevailed. Now the problem is, where is the next "low" to come from? The answer to which is, "upon which side will another area of "high" encroach?"

From the 6th to the 9th, this question remained unanswered. There was but slight change. Then an area of "low" appears in the extreme northwest and another in the southeast. The first developes the most rapidly,—the "jug-neck" again, less distance to travel, line of least resistance, fewer opposing forces,—but vanishes out our of sight north of Lake Superior on the 12th. The "low" to the southeast moves inland, and then during the 12th, 13th and 14th takes its usual northeast course, and so off the map.

Again on the 15th an area of high barometer prevails over the United States, which breaks up slightly during the 16th, 17th and 18th, and partially developed areas of less pressure show here and there, and move northeast.

On the 18th, a well-marked area of low barometer (lying northeast and southwest, oval shaped, 90 by 300 miles, with a pressure of 29.70) is near the center of our map. We conclude that this indicates antagonistic areas of "high" to the northwest

and southwest of it; and on the 19th these appear, the low scudding before it, or seeming to do so, while the high augments in volume, as a rock seems to grow into an island as the ocean ebbs from around it. Oct. 21st to 24th, appears to be devoid of eccentricities. On the 27th, with an area of "high" in the middle of the northwest quarter of our map and another upon the Atlantic coast, there reposes between them a lower pressure over the lake region.

From the 28th to the 31st, an area of low barometer passes from Alabama to New England.

There is not space to more than outline some general modern meteorological generalizations. The distance between areas of high barometers is not over 3,000 miles. As they approach nearer than this the definition of the "low" is more and more marked. They seem to lie over this continent, to each other northwest to southeast; at least the southern area seems to encroach so as to out-flank the northern one to the east.

The direction of the wind at the surface is a matter of minor importance. It does not determine scarcely anything. When the tide is passing through a channel filled with rocks, especially from many points of entry, there will be many conflicting currents. Suppose the aerial sea that surrounds this globe has its billowy upheavals like the ocean? We have proved a polar atmospheric ocean and one at latitude 32, both of superior pressure to that which lies between them. Would there not be found at its line of meeting and commingling, a series of atmospheric vortices which would mark their presence by barometic fluctuations? The southern sea being the larger would give the resultant line of direction. As these vortices moved along this line over areas of low pressure, storm centers would result.

Thus the final explanation of these low barometers will, I think, be found to reside in the theory of atmospheric tides." As birds fly by the variation produced on a single direct motion by the center of their wings, so all the variations in low barometer tracts can be referred to the interaction of waves sent off from the polar and southern air seas. Naturally the transient phenomena is the first to be observed, its measurement attempted, its relative frequency commented upon. Fire was once esteemed a primary element and today it is easier to measure the flame of a burning gas jet than to calculate in advance what the figure will be from an unlighted aperature. A local disease receives treatment in many instances locally, and not as an exhibition of some fault of the system as a whole.

The daily atmospheric tide occurs with great regularity, being high at about 10 o'clock morning and night, and low about four. It does not seem to lay as does the grosser fluid of the ocean, nor give rise to supposed coincidence in its movements

with the rising of the moon. That it is the sun and not the moon which rules the oceans' currents, is at present understood.

This daily tide being admitted we can advance a little farther and say that as at the poles and south of latitude 32, there is known to be a greater density of the atmosphere than intermediately, the daily tide will then have a tendency to accumulate and flow over this intermediate space from both sides but with the stronger power from the southern sea. This "overthrow" or wave will occur about once in three or four days, and would be regular in its action were the conditions causing it, regular, but these conditions not being invariable (notably the inclination of the ecliptic), the line of the interference of the waves of the polar and southern areas will vary continually. There will be a certain periodicity taking one year with another, or, eliminating accidental influences, by comparing a number of years, but the reciprocal conditions will scarcely ever be found. Sometimes the polar "off-throw" will be stronger than usual, and the meeting line will be pushed farther south, and again the northern area will encroach very far upon its northern rival. But if we take the average conditions and show that at certain intervals, the vortex of meeting will be in the northwest, and at other times in the Gulf of Mexico, even with this as a general condition we have made a great advance towards a scientific explanation of the phenomena.

It is probable that the mechanical influences will prove more effective than the dynamical in most atmospheric phenomena. It will be cold with a wind of several days continuance from the north, and warm with the wind from the south, because the air will bring this temperature with it, and seldom from influences due to evaporation, condensation and similar dynamic results of the inter-mingling of air of different temperatures.

But the mathematical formula for thorough elucidation of weather conditions will not be an easy one, nor will it be one that an untrained intellect can successfully complete. In a popular magazine a general idea of atmospheric conditions can be explained sufficiently clearly. But scientifically the problem is only pushed back a little and removed into the hands of a few skilled students of Natural Philosophy.

SHAKESPEARE'S CHILDHOOD.

In the early part of the sixteenth century, there lived upon an estate of Robert Arden, at Snitterfield, in Warwickshire, a tenant farmer whose name was Richard Shakespeare. This farmer had two sons who had received at the baptismal font, the names of John and Henry. Of these, the

former seems to have possessed an adventurous disposition; and finding the monotonous life of a farmer too sober for his aspirations, turned his back upon the rural solitudes of Snitterfield, and sought a more congenial career in the parish town of Stratford-on-Avon. His brother Henry remained at home,—content to assist his father's labors during his life-time, and at his death succeed him as tenant of Robert Arden's fertile acres. The impulse that moved John Shakespeare to settle at Stratford was, unquestionably, the same motive which has always impelled unquiet and ambitious minds to uncover their talents to a wider audience than destiny provided them at their birth. "To be of worth and worthy estimation" is the lode-star of such minds; and the contemptuous neglect, or grudging praise, of rustic familiars, forces them into the great world in search of a suitable atmosphere to mature "the blossoms of their fortune." Upon every highway that leads to populous haunts of men the footprints of ambition point townwards; and thither its votaries must go to seek applause for wisdom, wealth, or honor. Allured from obscurity by such aspirations, young Shakespeare found himself, in 1552 an humble tradesman at Stratford, prospering in the accumulation of wealth and rising in the estimation of his townsmen. With the land-hunger so common to those just emancipated from tilling the soil of others, he devoted his first savings to the purchase of real estate—two tenements in Stratford; in one of which was to happen an event more important to England than the birth of a prince or the gaining of a battle. At this time he was a bachelor, and if the antique records of the corporation may be credited, his housekeeping was no more cleanly than that of modern animals of the same species. He was fined, in April, 1552, the sum of twelve-pence for throwing slops in the streets. This was a hint in favor of matrimony that may have induced him to think seriously of a matter which young men are prone to put off, with the call for repentance, till a more convenient season. For some reason, however, his reflections bore no immediate matrimonial fruit, and five years were suffered to pass by before bachelor John exchanged his dirty and cheerless lodging for the domestic comforts of "Benedick the married man."

Robert Arden, of Wilmecote, the landlord of John Shakespeare's father, was a considerable figure in Warwickshire. He owned estates at Wilmecote and Snitterfield and, at his death, his personal property was appraised at nearly seventy-eight pounds—a sum which, at this time, would be equivalent to about four thousand, five hundred dollars. In those days of small fortunes the lucky possessor of such means was placed in a position of great provincial influence and respectability. Indeed claims have been advanced by various writers that the Ardens were of

gentle lineage and connections. It is said that, in times past, the family had shone at court; and that John Arden, Henry the Seventh's Esquire for the Bath, was a relative of the Warwickshire Ardens. Besides there has been found, amongst the Archives of the College of Arms, a manuscript which speaks of the "ancient cote of arms heretofore assigned to" Robert Arden of "Wellingcote" in Warwickshire. But there is no proof that such a blazon even existed and we must be content to look upon him as a yeoman farmer, enriched by industry and thrift and entitled by grace of nature, not heraldry, to "golden opinions from all sorts of people." By his first wife, whose maiden name has not been preserved, Arden was the father of seven daughters, five of whom survived him. Shortly after the birth of her youngest daughter, Mary, poor Mrs. Arden having completed her earthly destiny, "made a groan of her last breath" and left her good man a widower. The lusty old gentleman soon grew tired of celibacy, and, looking about for a helpmeet, fell into the toils of widow Agnes Hill, nee Webb, who very easily gratified her ambition to become the partner of his bed. This occurred sometime during the year 1550,—the period when John Shakespeare left Snitterfield for Stratford. At this time three of Arden's daughters were married. Agnes, having first been married to John Hewyns, was left a widow, but readily secured a second husband in Thomas Strynger, of Bereley; Joan had married Edward Lambert of Barton-on-the-Heath, and Catherine was the wife of Thomas Etkyns of Wilmecote. Alice and Mary remained unmarried and kept house for their father till the advent of their step-mother; then no doubt, the new mistress of the manse took possession of the keys which had dangled from the trim waists of Alice and Mary and criticized severely the domestic arrangements of the young housekeepers. How, or when, or whether, Alice was relieved from the dominion of her step-mother does not appear, but we find her at the death of her father seven years afterward, still unmarried as well as her younger sister Mary. As for Mary, it is opined that a certain young tradesman of Stratford, had grown to be a familiar figure at Wilmecote on holidays and summer evenings, and that the gossips of the neighborhood were quite scandalized at the possibility of pretty little Mary Arden marrying the son of her father's tenant. It is not likely that the old gentleman himself was pleased at the prospect; at any rate the lovers were not "conjoined in the state of honorable marriage" till after his death.

This event occurred sometime in the year 1557. Bequeathing his "solle to Almyghtye God and to our Bleside Ladye, Saint Marye, and to all the Holye Companye of Hevin," and his "lande in Wilmecote, cawlide Asbyes" to his daughter Mary and remembering his other children

and his wife in less substantial bequests, the prosperous yeoman took his place among the generations who have "trod the way to dusty death." His testament leaves us in no doubt about Mary's place in the estimation of her father. She was still his youngest child; for the second Mrs. Arden had presented him with no competitor to snatch from Mary's brows the crown of love that falls upon the latest born. Yet, despite her youth, she must have shown mental qualities of a superior order; for the shrewd old man appointed her, together with her maiden sister Alice, "ecxequtores" of his will, to the exclusion of their eldest sister and their indignant stepmother. This partiality was no doubt as unpalatable to the Stryngers, the Lamberts and the Etkyns, as it must have been to the Webbs; and we may be assured it was caused by a potent influence to have outweighed the arguments of the nuptial bed, as well as the maturer age and experience of Agnes, Joan and Catherine. Beyond the confidence reposed in her sagacity and discretion, Mary must have possessed her father's most tender love and regard; perhaps the consequence of those amiable traits of character which reappeared in her illustrious son and drew from his associates such reverence and affection.

The estate called Asbies, consisting of a house and sixty acres of land, was not the only dower of pretty little Mary Arden. At his second marriage her father had settled upon her and her sisters the reversion of other property at Wilmecote and Snitterfield, including the farm occupied by Richard Shakespeare. Possessed of such means the young heiress could look beyond the rustic and humble swains of her station and hope for a more knightly lover; but her steadfast and sensible mind fixed itself upon one object and the obscure young tradesman of Stratford found himself, a short time after Robert Arden's death, the master of Mary's maiden charms and modest fortune.

John Shakespeare and his young wife commenced housekeeping in his house on Henley Street in Stratford-on-Avon. Adding the dower of his wife to his own considerable savings Shakespeare was placed in easy and respectable circumstances. After his marriage followed happy years of prosperity and honor. His course of life from his first settlement at Stratford in 1550 until his marriage, in 1557, was of such a character that, when wealth laid upon him its powerful wand, his townsmen recognized in him a man "whose worth and honesty is richly noted." After mounting through several stages of official life, he was finally chosen Mayor, or High Bailiff, of Stratford. This happened in 1568; and for ten years longer his fortunate star remained in the ascendant.

In the meantime John Shakespeare's wife had not escaped "the pleasing punishment that women bear." Having first presented her

lord with two daughters, who died in infancy, she gave birth, some days before the 26th of April, 1564, to the divine child who was destined to make the name of Shakespeare a household word in palace and cot—wherever the gracious influence of letters should penetrate. When his great son was born, the happy father was Chamberlain of the Corporation. He was engaged in business as a glover, in connection with which he marketed the fleece and the flesh of his flock of sheep, and dealt more or less in timber and cattle. He owned the house in which he lived on Henley Street, another on Greenhill Street, besides other properties scattered about the town and vicinity. He had the income from the farm at Asbies and a valuable interest in the share of his wife in the Snitterfield and Wilmecote estates. Notwithstanding such prosperity and the superior talents evinced by the man upon whom it had fallen, the father of William Shakespeare could neither read nor write. Such a man must have felt his ignorance keenly; and who can doubt that he resolved to educate, in all the learning of his time, the boy whose advent graced his happiest and most auspicious days. He possessed for the period of fourteen years after the birth of the poet, ample means to perform this resolve. In 1565 he was elected Alderman; in 1568-1569, Bailiff; in 1571, Chief Alderman and in 1575 he purchased two more houses on Henley Street. From this year his affairs commenced to decline, but he was still solvent and of good reputation until the year 1578. The period within the years 1564-1575, that is the first eleven years of William's life, marked the flood-tide of his father's fortunes; and they did not grow desperate till the poet had reached his fourteenth year. During this time John Shakespeare was one of the most influential citizens of Stratford; and, for some years he was its Chief Magistrate—a position, then, of considerable pomp and circumstance. The eldest son of the first citizen of Stratford must have had better oportunities, in the matter of education and experience in life, than the humbler children about him. He must, at least, have received every advantage afforded by the educational institutions of Stratford. These advantages were far from contemptible. In the reign of the fourth Edward, Thomas Jolyffe had founded in the town one of those parochial schools for the teaching of latin which then began to be introduced into England through the auspices of the Roman Clergy. This school seems to have prospered, for the sixth Edward granted it a charter. From 1572 to 1578, that is from the eighth to the fourteenth year of young Shakespeare's life, the masters of the Stratford Grammar School were, successively, Thomas Hunt and Thomas Jenkins. In those times, a boy was placed at school, if at all, in his seventh or eighth year. Before admission it was necessary

that he should have learned to read and write; this was essential as the school did not undertake to give primary instruction. From this fact we may know that the poet received the teaching, for a time, of private tutors, for neither of his parents could read or write. When the quantity and quality of learning imbibed by his son was sufficient, perhaps in his seventh year, John Shakespeare followed the usual custom of prosperous citizens and placed him at school. Who can doubt, then, that from this time until the melancholy year 1578, William Shakespeare was assisted in his studies by masters whose interest it was to devote their utmost care and skill in behalf of the son of the foremost man in the town. The curriculum of the school was limited in range, but thorough in scholarship. It comprised a latin course and the rudiments of scholastic philosophy. By the method then in vogue the rules of grammar were illustrated and enforced by exercises which gave the pupil a practical knowledge of the principles of composition and corrected his taste; and it was absolutely necessary that the laws of verse should receive attention from those who scanned the hexameters of Virgil or the varied strains of Horace. History, mythology, philosophy, were at hand, clothed in the pompous garniture of latin, to reward the student whose inclination led him to attempt their mysteries. Having received the utmost advantage that the school could bestow the student was ready for college; and it is a matter of speculation whether the acquirements of the poet, when he quitted school, would, or would not, have sufficed to open the doors of Oxford or Cambridge to him. There seems no good reason to doubt his fitness to enter the University; indeed it seems quite probable, in view of his advantageous birth and fortune, as well as his powerful and retentive intellect, that he had imbibed "the rudiments of many desperate studies." The love of reading once acquired is as tyrannical as the love of gambling; "keep a gamester from his dice and a good student from his book and it is wonderful." It grows by what it feeds on and it finds new food in the most barren and unlikely places. It reaches far and wide and penetrates into secret nooks and rises to unwonted heights, or sinks below its mean, happy in the midst of travail if its search be successful. Guided by this enthusiastic and omnivorous instinct Shakespeare could not have missed reading the few books at Stratford, in the hands of his schoolmasters and tutors, or the clerical incumbents of the parish. These were for the most part latin classics; but it is not likely that Chaucer and Sackville and Harrington were altogether unknown in Stratford. Perhaps copies of the rude dramas of Marston and Taylor had found their way thither in the company of some traveled provincial or wandering cit; and Ascham's "Scholemaster" might well

find place on the scant shelves of dominies Hunt or Jenkins. Whatever books could be found at Stratford would certainly be within the reach of young Shakespeare, and that he read all he could discover is certain to a demonstration.

At any rate we know he had six years of schooling; and six years of a bright boy's age, from eight to fourteen, is a lifetime for an ordinary plodder. At that age many aspiring minds have presented enduring credentials to fame. Chatterton, Pope, Paschal, our own Bryant, and, in some degree, more lately, the Goodale sisters, have shown that youth and inexperience does not prevent the fair buds of genius from blossoming. Youth and erudition, inexperience and enlightened sagacity, are not so infrequently found in each other's company that we wonder to find them so; indeed as we read of the intellectual exploits of Porson and Spencer and Paschal, when scarcely beyond the years of childhood, our surprise and admiration are tempered by the knowledge that many English, French and Yankee lads exhibit the same proficiency now-a-days.

When Young Shakespeare had reached the age of fourteen years, his father's good fortune seems to have deserted him. His descent was as rapid and disastrous as his rise had been gradual and auspicious. In this fatal year, 1578, Mary Shakespeare's farm at Asbies, was mortgaged and eventually lost; her interest in the other lands alienated; her husband, distracted by the ruin of his fortunes, became irregular in attendance at the corporation; and, so fallen was his estate from its former "high blown pride," he was exempted from taxes for the poor rates, on the plea of poverty, and declared in default on a tax for arms. In this year, or shortly thereafter, young Shakespeare was taken from school. The encroachments of poverty still continuing, his father was fain to reduce the hungry mouths at home by apprenticing him to a butcher. At the age of sixteen all boys are poets, full of fantastical notions, clairvoyant to the most sensuous and riant influences in nature; but the fancy that in a few years was to create a Romeo and a Juliet, and run riot in "Venus and Adonis," must have marked its possessor with a more powerful and enduring afflatus than the *dolce far niente* of puberty. The delicately humane mind that could describe the wounded deer in "As You Like It" with such pathos and feeling must have found the bloody and brutal occupation of a butcher repulsive to the extremest sense. Obeying with reluctance the commands of filial duty the youth exchanged the sweet companionship of letters for the obscenities and brutalities of the slaughter-pen. This was the "bloodiest shame, the wildest savagery, the vilest stroke," that could befall a disposition so full of gentleness and sensibility; yet the experience had its function in developing the universal

mind of Shakespeare. There is a silly tradition that "when he killed a calf, he would do it in a high style and make a speech"—thus finding a congenial atmosphere for the germination of histrionic genius in the fetid vapors of the abattoir. Perhaps in some boyish freak, during the absence of his master, the youth enlivened his grim duties by stabbing Cæsar, or relieving Macbeth of his head, in the person of his bleating victims; but this must have been hysterical amusement at the best. There is more food for tears than smiles in such a story. Like an infant lost upon a battle-field, he may have dabbled his hands in blood and played with the horrors around him; yet the realization of his unhappy situation was ever present. But the black cloud had the usual silver lining. There were holidays and moonlit nights for journeys and boyish escapades in the environs of Stratford. In the company of other youths, as wild and wanton as himself, he may have often scandalized by his conduct the staid burghers of the town, and furnished in himself the model for the future Prince Hal. Yet, while cast by despair into such courses, he could not live surrounded by the lovely scenery of Warwickshire, without developing his natural love for the sublime and the beautiful. The sinuous Avon, winding between grassy banks, redolent with the odors of wild flowers; the Charlecote park and its abundant deer; the surrounding hills, tinted with the delicate hues that nature lends to distance in that climate; a sky almost Italian in brilliancy and the traditions that always hover in the air of little country places, making their heroes, their fairies, their myths and their ghosts so real that even the sober touch of age cannot dispel them, all conspired to form the master genius which was suddenly to spring to maturity. Under these influences the boy grew toward adolescence unconscious of his powers—a foundling Appollo fostered by mortals who could never realize or appreciate his divine superiority.

THE ACHIEVEMENTS OF MECHANICAL ENGINEERING.*

Gentlemen,—Among the various duties devolving upon the president of this society, is that of saying something at the time and on the occasion of his retiring from the position of honor in which you had previously placed him. With no hope of making up in prating words for any of my previous shortcomings, I accept this duty now devolving upon me, and shall attempt, briefly, to say something about the mechanical en-

*Address of retiring President, J. P. Holloway, to the American Society of Mechanical Engineers at the sixth annual meeting held in Boston, November 10th, 1885.

gineer, his position, and mission.

Brief as is the history of this society, it has already been shown that there was a necessity for its organization and existence, and the rapidity with which its ranks have been filled up, and the character and standing of its members, alike show how widely felt was the want of some nucleus about which the members of our profession might cluster.

Of the advantages that will in the future grow out of the formation of this society it is yet too early to speak, but the benefits that have come to us all by reason of our connection with it, by reading the published transactions, by attendance at its meetings, by participating in the discussions, and, above all, by the pleasant acquaintances made at its social gatherings are, I am sure, not only apparent, but are fully appreciated by all whose good fortune it has been to join in them. The term engineer, is a generic one, capable of being divided into a great many subdivisions; just how many it is difficult to say, as the necessities of civilization, and the advancement of science has made it necessary to add new specialties, each of which is of sufficient importance to occupy the full time and energy of a special engineer in order to master and direct its details.

While I would render honor to all branches of the profession of engineers, and would most certainly underrate none, I cannot but believe that in depth and breadth of usefulness, and for the final consummation, and for those final practical results that best promote the comfort, safety and progress of humanity, the mechanical engineer, by reason of the fact that he, most of all, is concerned in the moulding and directing of the material forces of nature, stands the peer not only of any other engineer but of any other man as well. It was well and truly said by one of the founders of this society, that the profession of mechanical engineering underlies all engineering, and it requires only a moment's thought to make this apparent.

While the civil engineer may plan and locate his railways, canals, aqueducts, bridges or tunnels, it is the mechanical engineer who is called upon to devise the machinery and tools with which they are to be constructed.

The naval or military engineers, guided by the experiences of the generals or warriors of the past, may plan defences by land, or sea, may design forts, or iron-clad ships, but when their resources are exhausted, it is the mechanical engineer who is called upon to build the ships, load them with defensive armour, and to not only provide them with powerful guns but also to provide the mechanism by which not only the guns are to be handled, but by which the ship itself shall be manœuvered and driven, alike through stormy and calm seas.

As an example of the fact that in the prosecution of modern warfare,

the mechanical engineer has become a most important factor, it is said, that during the progress of the late Riel rebellion in the country adjoining our northwestern boundary, one of our engineering firms which manufacture a rapid running multiple gun, with a view of extending their trade, sent an agent with one of their guns to the scene of strife, hoping that owing to the scarcity of troops, and the difficulty of transporting them up there, they would find a market for their machine gun. The agent arrived in camp just at the time when, after a good deal of marching and counter-marching, the belligerents were at last by design or accident brought face to face. With the push natural to an American, the representative of the firm was early on the ground, and running his machine far in advance of the regular troops he unlimbered his gun, and grasping the crank devoted himself to the task of showing what a mechanical soldier could do, and the account said, that, unmindful of the storm of bullets that flew about him from the opposing foe, he turned his crank with such increasing energy that he actually won the battle before the regular soldiers had a chance to fire a shot. While this incident serves to illustrate the value of the mechanical engineer and his contrivances in modern warfare, it is only proper and just to say, that the success in this case was largely due to the pluck and industry of the American drummer who turned the crank.

How helpless would sit the mining engineer above his earth-bound treasures, be they never so rich, did not the mechanical engineers come to his aid to lift them from out their rock-ribbed home, and with fiercely fanned furnace fires free them from their impurities and dross?

Even the giddy goddess, fashion, whose ways none can fathom, would, like Alexander, sigh in vain for other worlds to conquer, did not this same mechanical engineer, like gallant knight of olden time, come to her aid, and with ingenious and studied transformation of wheels, and cams, and flying shuttles, bring new combinations to woof and warp, whereby the silken threads turned into new channels, reveal a hitherto hidden beauty which, for the time, captivates all beholders. And so it is through all the industrial pursuits of life which require for their prosecution the handling and the transformation of crude materials into forms of usefulness and beauty.

While it is true that scientific and technical training is, and must ever be, of great advantage to the mechanical engineer, there is yet another source from which, after all, he will derive by far the most benefit, and that is—experience. Not necessarily his own experience, but the experience of others, and of all ages as well; and I know of no other way that he can be so benefitted, and aided, all through his life.

I ever think of experience as of a vast store-house, the corner stone of which was laid upon that day when the unbarred gates closed behind our first parents as they left the paradise of Eden; a storehouse to which each successive day since that time up to yesterday has added extended length, and increasing stores. In this vast edifice every man of every occupation or profession, has had his nook in which to pile up the experiences of his life. Of the great mass of knowledge therin stored, hidden by the accumulated dust of ages, little has come down to the present, but who does not regret that more cannot be known of the members of our own profession, who in remote ages builded so well that even the ruins of what they accomplished challenge our admiration now. What an addition it would be to the literature of engineering, could we have the clearly interpreted published transactions of these engineers, who, thousands of years ago, built a Suez canal through a country in which in our day DeLesseps could do no better than to follow. Could they be spread before us how much of interest would cluster about the discussions of the mechanical engineers who planned the pyramids, and contrived and executed plans for quarrying, transporting and erecting those numerous obelisks that once dotted the plains of Egypt. Who would not, were it possible, scan with interest the drawings and plans of those engineers of ancient Carthage, who, when Europe was fringed only on its southern limit with civilization, came over to Spain, built pumps, drained and worked mines opened ages before by other and to them unknown engineers.

The steady, onward tread of those Roman legions which once made Rome mistress of the world, was made possible by the labors of the sagaicious and skillful engineers who built for them imperishable roadways, spanned rivers with bridges that are marvels to-day, and who laid so deep, so permanent, his foundations in the then far off "Isles of the Sea," that the engineer of the present, as he excavates for his railways and buildings, often reaches the imbedded stone or crowning arch laid by his professional brother thousands of years ago.

But, not alone would we be interested in knowing something of the experiences of those far off engineers, who in the dim past accomplished so much with so little. We would as well be greatly interested, and greatly enlightened could we know more of those who nearer to our own time have accomplished so much for the benefit of the world at large. While it is true we may go to that garret in Heathfield, where he whom we are now pleased to call the father of the steam engine, James Watts, lived and labored, and may stand beside the bench whereon he worked, may see the lathe which yet has in it the unfinished job he left there, and beside which his leathern apron lies as

last he laid it down, and while all these from their associations would be of especial interest to us all, who know how much the onward progress of the world was hastened by what he accomplished for the steam engine, there will still remain much we shall never know of James Watts and his experiences. None will ever look upon James Watts' scrap heap; one can do no more than imagine of his studying, his planning, his model making, his trials, and his failures, as he worked out the problems of expansion, contrived the condenser, air pump, wave motion, governor, indicator, and indeed every important feature of the successful steam engine of to-day. That he had a scrap pile which received his failures we may well believe, for where is the engineer, who has accomplished anything worthy, who has not hidden away in some secluded nook, or corner, his pet schemes that come to naught, his long dreamed of hobbies which some inexorable law of nature defeated; his neglected but never quite relinquished models, which were to work wonders, and over which at long intervals he sits and dreams, and promises himself at some time in the future to take in hand and work out to a successful ending. That level-headed, canny Scotchman, George Stephenson, who drove the "Rocket" at Rainhill on that September day in 1829, and whose practical, good common sense and industry did so much to make the railway and locomotive of his day a success, has hidden away in his lock-up, in the vast storehouse of which I have spoken, several, need I say unfinished, models of perpetual motions.

It is said of the late Matthew Baldwin, one of the earliest and best known builders of locomotives, one whose practical good sense, industry, perseverance, and long-accumulated experience contributed more, perhaps, than that of any one else in bringing the American locomotive to its high degree of efficiency, that all through his life he was haunted with an idea that a rotary engine could and ought to be used for propelling a locomotive; and, no doubt, that in his pencil sketchings, among his models, and in his scrap corner during his life, might have been seen here and there the outcrop of a hobby which in his dreams and in his leisure moments rose up before him like Banquo's ghost, and which, like it, in spite of all his failures, "would not down."

Since time was young, it has been the mechanical engineer, working often in the most obscure manner and in the most humble circumstances, who in the end pushed rapidly forward the car of progress.

While it is possible, by the aid of history or tradition, to trace back to their origin some of the innumerable inventions which have so benefited the world, how many yet remain about which nothing is now or ever will be known. Think for a moment of that vast host lying in unknown

graves, who in the past, amid poverty and discouragements, toiled from early morn until the night was well spent, in some obscure garret, or smithy, or workshop, to devise and perfect some simple machine, to contrive or manufacture some article now so common, so universally used, that its sudden removal would work a world-wide injury. While none will question the value of the engineer in aiding the progress of the past, all will, I think, agree that at no time in the history of the world was he so important a factor as he is to-day.

Standing in a city whose enlarged culture and great wealth was made possible by, or indeed is the direct result of the labors of the mechanical engineers, who by their skill and industry have filled all the valleys of New England with flying Spindles, busy wheels; whose ingenuity has relieved all labor of its drudgery, and whose inventions have given their country a world-wide renown, I need not, I fancy, speak at large of the mission of the mechanical engineer, or of what he has accomplished.

A stranger standing in the midst of the glories of Westminster, asked to be shown the memorial or monument of the builder. He was told: "Would you see the monument of Sir Christopher Wren,—gaze about you." So answer I. Would you know the mission of the mechanical engineer,—gaze about you wherever in the civilized world you may be.

Putting aside all the wondrous history of by-gone ages, blotting out all the engineering triumphs of the middle ages, calling the time of Shakespeare, and Milton antiquity, and coming down to within a brief century, or if you will, to the brief span of a single generation, and what, or rather what not, has the mechanical engineer accomplished. So broad, so varied, and so universal has been the field of his action, and of his triumph, that I find no time to begin even an enumeration of what he has done. A thoughtful woman gazing at the ceaseless, steady action of an immense engine, driving with tireless speed the ponderous steamship through storms and calms, said half in soliloquy, but wholly in earnest, "Engineers ought to wear crowns."

While it is true that at least in this country the position of any man or set of men will be what they themselves make it, it is nevertheless a fact that the public at large are wont to accord eminence and praise to those most in view, and oftenest heard. In the history of the olden time it was the kings and rulers who occupied much of the attention of the public. Later on, and for a much longer period, it was the chieftain, or warrior, whose praises were sounded by the orator and poet, and the prowess, the bravery and chivalry of the Knight Errant, surrounded with environments of waving pennons, floating banners, and glittering armor was the theme of poetry and song through many ages.

Hannibal and Napoleon, with their armies, crossed the Alps. Their

pathway amid the clouds was strewn with thousands upon thousands of those who fell by the way, and of the proudest armies who at their base began the ascent, comparatively few reached the sunny plains beyond.

They had indeed crossed the Alps, but behind them their snowy peaks defiantly touched the clouds, unharmed, unconquered. Long years after these warrior chieftains had crumbled into dust, another, mightier than Hannibal or Napoleon, came to the foot of these rock-barred barriers, which for the ages past had defiantly said alike to king and peasant, "Pass me only at your peril." With no long retinue of soldiers, no vast caravan of horses and elephants, and bleating herds, no waving banners, no blare of trumpets or cry of herald, came the conqueror of our day. Seeing the weary traveler and burdened beast climbing with patient toil along the narrow pathways, and about the storm-beaten crags half hidden in the clouds above him, and beside yawning gulfs no eye could fathom, he bethought him of a better way. Seeing near by a rushing torrent, which for ages had nnconfined, tossed high in the air its flakes of foam, he knew he had in that a giant force to do his bidding, so, curbing and guiding its wild spirit, he bade it turn his wheels, swing his cranks, move to and fro his ponderous plungers and pistons. He made swinging valves at each opening stroke to gather in that wildest, freest and most untamable of all elements, one of which it was said long, long ago, "It bloweth where it listeth"—the air—and driving it before him through long and tortuous passages, he made it to knock with arm of steel upon the portals of the hitherto impenetrable walls. You know the rest, with highest skill, and unceasing industry he bade the spirits of the air, and water, alike to his behest; guiding them to the right and to the left, up and down as occasion required and from either side, through months and years, until at last the hitherto defiant walls are broken down, and the eager men leaped through the rent mountain, not to engage in deadly conflict or savage hate, but to clasp each other in bonds of equality and fraternity. Through this open portal, to-day, on roadway of steel, luxurious carriages glide swiftly and securely, filled with the inhabitants of all lands, on errands of peace, pleasure and good will. Other vans loaded with the product of the field and vine, the spindle and the loom, alike pass from Italy's sunny plains to the north land of snow and ice, for barter or exchange.

Need I ask who conquered the Alps, the soldier, or the engineer? Need I ask whose triumph has contributed most to the welfare of all the world—the generals who went over the Alps, or the engineer who went through them? Let Mont Cenis and St. Gothard answer.

The day of the professional warrior, the swash buckler of camps, whose sword was on hire for any cause, has

passed forever and he is fast dropping out of sight. That there are, and it is to be hoped ever will be, men who for their country's defence, and for the cause of right and justice, will peril their lives on the field of battle, we fully believe. 'Twas such a one who, but a short time since, was borne to his last resting place, followed by a nation in mourning, and, for whose requiem tolling bells, beginning with the early dawn upon our eastern coast, awakened new echoes in every town and hamlet across the broad continent, until with the setting sun they died out amid the murmuring waves of the Pacific.

As the comrades in arms of this great man came together to devise some memorial that should perpetuate his worth and keep his memory green, with one accord they said, let not his monument be of broken swords, and captured guns, with all their attendant memories of conflict and strife, but rather let the sculptor with his highest art and best skill, transfer to the enduring marble the semblance of the great citizen, sitting in the shadow of his home, and under the shadow of an impending fate as well, facing calmly death, which, baffled on a hundred battle-fields, held him now within easy reach, tortured with a pain we can but at best imagine, using his last hours and waning strength in writing a memoir; not to place himself higher on the rolls of fame or in the hearts of his countrymen, but to leave behind him comfortable sustenance for the family he so much loved, and from whom he was soon to part. This sentiment of his comrades, the officers and soldiers of the Grand Army, and which so accords with the feelings of all who admire the kindness of heart, the inflexibility of purpose, and the absence of all vindictiveness of the great warrior, and greater citizen, General Grant, illustrates most fully the change in public sentiment of which I have spoken; and illustrates, as perhaps it never so well illustrated, the truth of the saying that "the pen is mightier than the sword." And let me add, that among the pens that have accomplished mighty results for the progress of civilization, liberty and equality, is the drawing pen of the mechanical engineer.

There remains but one more thought to which I beg your interest and indulgence, and that is the position of the mechanical engineer with regard to his fellows. It is not many years ago since, when the mechanical engineer knew far more of the men of all professions than he did of his own. It was not many years ago that the leading members of our profession knew but little of each other, except by reputation, and I disclose no secret when I say that there was little endeavor made to do away with the exclusiveness and distrust, to use no harsher term, that to a certain extent was prevalent then. Happily all this is changed now. The formation of this and similar societies, the frequent meetings of conferences held

the comparison of methods, the recitals of our successes, and the avowals of our failures, together with the knowledge that has come to us all by reason of this interchange of views and experience, makes us all to feel that we live in a wiser and better age.

But not alone in a professional way have we been benefitted by these gatherings. The harmonious union of men, standing high in the attainments of their profession, high in the regards of the public; representative men in communities spread all over the land, by such meetings as this, held in the important industrial cities of our country, in each of which their best citizens have come forward to greet us with most cordial welcome, there has been shed a new luster upon the profession of mechanical engineering, and it has been raised to a still higher plane of usefulness and observation. But better than all, by these meetings we have come to know each other, as in no other way would it have been possible. In this acquaintance, we have been taught a broader charity for each other's feelings; we have come to know something of each other's trials and misfortunes, and to find on every side warm hearts, filled with generous impulses ready as well to give as to receive.

Let it be our ambition to so conduct ourselves that we shall ever honor our calling, and shall assist in raising it in the estimation of all to that high position of honor and usefulness to which, by reason of what it has done, and is doing for the world and humanity, it is so justly entitled.

GOLD MINES AND MINING IN CALIFORNIA.

The auriferous territory of California is so extensive, the deposits so numerous and diversified, the implements and methods employed in working them so various, and their development in such different stages of progress, that in writing about these things, one can, in a mere letter, treat the subject in only a very general way. To enlarge upon or even mention idividual properties, enterprises, or localities, is out of the question; some brief remarking on the above, more general topics being about all that can be done.

Proceeding, then, to deal with these topics in the manner indicated, it may be observed that the business of mining for the precious metals in California is in a fairly prosperous condition, being active, remunerative, and progressive in nearly all of its departments. In the matter of correcting former mistakes and purging this industry of its many abuses, much has been accomplished, winning to it the support of certain classes who before would have nothing to do with it. Owing to diminished water supply, the snow-fall having

been light on the mountains last winter, the

HYDRAULIC MINING

season has been a short one; the water in many localities having already given out, this being about a month earlier than usual. As this scarcity of water will stop also a few of the quartz mills, the annual bullion product of the State would have suffered some shrinkage had not this loss been made good by increased yield from river-bed operations, which, through the occurrence of a low stage of water early in the summer, gain just to the extent that these other branches of mining lose by reason of a dry season.

Despite injunctions, a good many of the hydraulic mines continue to be run, their owners finding means to evade the restraining process of the courts. The most of these mines are operated under leases obtained by the Chinese, who, through recourse to their peculiar methods, manage to escape arrest, or, if arrested, manage, by these same methods, to keep their leased claims, and also those they purchase, running all the same. In a few instances, the whites have also, under one pretext and another, been able to continue gravel washing, the plan usually adopted in these cases being for the responsible parties to keep out of the way.

THE WAY THE HEATHEN CHINESE DO IT.

By the Chinamen, however, a different course is pursued. If the process-serving officer, arriving on the ground, wishes to make an arrest, he is permitted to do so; that is, if he can find out who among a herd of jabbering pagans is the proper man to arrest; for he cannot take the whole gang into custody. If the minion of the law hangs around and persists in making trouble, some one in the lot is pointed out to him as the "boss," who, thereupon, is seized, carried off and locked up in the county jail, where he is suffered to remain, it not being the policy of his masters to bail him out. He does not, in fact, want to be bailed out. Why should he, seeing he is leading what, to him, is a life of luxurious ease —the public boarding and lodging him better than he ever was boarded and lodged before, while his employers allow him his usual wages as long as he is incarcerated? To fine the prisoner, as might be done, would, of course, be a farce. The plan of arresting the entire working force at a mine has not been adopted, as this would only be making matters so much worse. The responsible parties in these cases consist of moneyed men or laborers having money, and who associate themselves together for the purpose of leasing this class of properties, which under the circumstances, they are able to do on very easy terms. Once in possession, they know that, by recourse to the above methods of procedure, they can continue work without serious interruption. The expense and trouble they are put to in thus de-

feating the law and baffling the orders of the courts they do not mind in the least, as these companies, getting the mines all outfitted and in working order on very low terms, invariably make large earnings.

So far, the authorities have not been able to find any way of dealing effectually with these violaters of the law, and, failing to do so, there is danger that this class of mines will ultimately fall into the hands of these foreigners exclusively. In this event, besides the heavy loss entailed on the original owners, it would happen that none but Chinese labor would be employed in working them, while all the gold taken out would be shipped directly to China, there to remain. Such a result being imminent, it is highly probable that the Legislature of this State will, at its next session, take such action as will enable the owners of these enjoined mines to resume work upon them, having first built suitable dams and other receptacles for holding the coarser and more damaging portions of the *debris*. That they will be permitted to experiment farther in that direction is almost certain. The conditions favoring the retention of this material up near the mines have been every year improving, and are now such that it could be very effectually there retained by the means proposed. This would be relegating the question to the basis of Judge Temple's decision, afterward overruled by Judge Sawyer, who denied the mine-owners the privilege of making trial of reservoirs and dams. With Judge Temple's decision the miners would be content, building the impounding structures at their own expense. Were this course adopted, it would lead to a final if not altogether satisfactory disposition of this vexatious business; at least, so far as the farmers and miners are concerned.

It should be stated that not all the hydraulic mines in California have been enjoined by the courts from running. Only those in the more central tier of mining counties have been so stopped; in other words, those that outlet into the American, Bear, Yuba, and Feather rivers and their tributaries. Those located in Trinity, Siskiyou, and Del Norte counties, which discharge their tailings into the Klamath and its confluents, have not been molested, nor is it likely they ever will be, as none of these streams are navigable, nor are there along them any lands or other property, rights, or interests exposed to injury by this waste material from the mines. Though not conducted on as large a scale as are many of the enjoined properties farther south, the hydraulic operations along these northern rivers are quite extensive, and, by reason of the favorable conditions that obtain here, promise to increase both in magnitude and number. Besides exemption from the *debris* troubles, the country here is well supplied with water, which short and inexpensive ditches suffice to carry on the mines. The auriferous

gravel is tolerably abundant and of good grade, and, being but little cemented, and free from volcanic capping, can be worked effectively and cheaply, there being nearly everywhere fall enough to insure all needed dump. Looking over the field, there seems enough to warrant the conclusion that hydraulic mining, whatever inherent and extraneous obstacles it may have to contend with, is nevertheless destined to have a long life in California. The present annual output of these mines amounts to about two million dollars, less than a third of what it would be had not their production been so restricted by the action of the courts. As premised, the present is likely to prove a good year for

RIVER-BED MINING,

a business that was formerly carried on along nearly all the larger gold-yielding streams of the State, but now confined mainly to the Trinity, Scott, Klamath, and Salmon rivers, the little continuing to be done elsewhere being mostly by the Chinese. This, up to the time the rivers became depleted of their treasures, was a very remunerative and, therefore, very popular style of mining. Afterward, it fell to a low ebb, having been given up pretty generally to the Chinese. Of late years, it has experienced some revival, and when the several tunnels driving to receive and divert the water at points where the rivers make short curves, thereby laying bare long stretches of their beds, shall have been completed, there will be taken from these reclaimed portions of the streams such quantities of gold as will, in the estimation of those engaged in projects, tell sensibly on the gross product of the state. The river-beds in California will continue to be worked, for a time, at first with increasing and then, no doubt with gradually diminishing returns. The day of their final exhaustion is afar off—too far to much concern the present generation.

DRIFT MINING.

Through a general avoidance of the mistakes, very common and very disastrous during its earlier stages, this has come to be a tolerably safe and profitable branch of mining. It is pursued mainly along the channels of the Pliocene rivers, and under the table mountains in the more central portions of the State, where a good many enterprises of this kind are carried on, some of them costly and of great magnitude. While Forest City, in Sierra County, and the Damascus Divide, in Placer, remain prominent centers of drift mining, many other localities are coming into note, the partial suspension of hydraulic operations having imparted quite an impetus to this branch of mining. While the deposits adapted to be best worked by drifting are very extensive in California, their development will proceed slowly, as it takes time as well as money to explore and open them up. Thus far, they do not appear to have recom-

mended themselves to capitalists, nor are they likely to do so in any special manner. Experience has, in fact, shown that they can be worked to best advantage by associations of practical miners, all the marked successes in the drift diggings having been achieved by companies of this kind. The gold product from this source is estimated at between three and four million dollars a year. It will, in the course of a few years, be considerably larger. The various

OTHER BRANCHES OF PLACER MINING,

such as hand and ground sluicing, working the beach sands and the seam diggings, re-washing the tailings, etc., all continue to be practiced in California; now, of course, for the most part, only in a small way. In the winter, when water is plentiful and free, ground sluicing is carried on in many localities. In the summer, some of the gulches are worked over, the bed-rock being dug deeper and the banks washed further up. Schemes for moving and washing over the tailings that in great quantities have lodged in the mountain ravines are in progress; Slate Creek and Shirtail Canon being the sites of the most notable projects of this kind. Since the partial stoppage of hydraulic mining, some of the water before used in piping is employed in washing ground with which nothing could before be done in summer. The two large companies that own Gold Bluff, the strange deposit on the seashore, go on collecting much gold by the novel methods here practiced for thirty years or more, while small companies of miners, mostly "squaw men," contrive to make small wages washing the auriferous sands found along the ocean beach farther north.

And thus it is, the gathering of gold from the California placers goes on, their aggregate yield continuing quite large, notwithstanding that the world had come to believe these placers were depleted to the point of abandonment long ago.

It is, however,

THE QUARTZ MINES

of California that are to prove her most prolific and permanent source of gold production. Having in a previous letter alluded to the increased interest taken in quartz mining in this State, it will suffice to say now that such interest continues unabated, being kept alive by the favorable condition and outlook of this industry in all parts of the State. In the depression, now so prevalent in most other lines of business, is to be found another incentive for our people to turn their attention so sharply to this branch of mining. In the field, work goes on very briskly. Prospecting is active, leading to the discovery of valuable lodes all over our auriferous territory. These finds are followed up very generally by development, and this again by reduction-works, of which a good many have been erected within the past year or two, some of them be-

ing of large capacity. As a rule, however, the old error of putting up mills too big or too soon is avoided. Out of this awakening to the subject of quartz mining, there has grown a corresponding interest in the means to be employed for reducing this class of ores. As a consequence, the inventors have been busy, and numerous are the new mechanisms and processes claiming the attention of the mining public. As many of our miners are men of limited means, and many of their lodes afford comparatively little ore, a small, cheap mill of improved pattern has come to be with them a desideratum. Among other machines claiming to fill this want is the Wiswell pulverizer and amalgamator, an improvement on the old mill and a Boston invention. It is simple, cheap, and durable, and appears to be doing good work; but if it wins at all, it will have to win on its merits, the average California miner being prejudiced against any thing having its origin abroad.

One of the special fights that is waged in this province of invention is that directed to supplanting the old-fashioned stamp by something more cheap, simple, and durable. While this end has not yet been attained, it is by good judges believed that it soon will be. That some gains have already been made in the business of beneficiating this class of ores in California, may be inferred from the fact that a great deal of quartz is now worked here with profit that does not pay over four or five dollars a ton; whereas, twenty-dollar ore was at one time rejected as worthless. While the yield of gold from this source will be somewhat larger this year than last, it will be yet another year or more before these presenting greater activities in the business will be made manifest in a largely increased production. The value of the gold taken from the quartz mines of California the present year will reach, and may possibly exceed, eight million dollars.

THE ESQUIMAUX.

The winter life of the American Arctic native, or Esquimau, is much more interesting than his summer existence, which partakes so much of the general life of savages with a few uninteresting changes, while in the winter time we have a mode of life so radically different from that of any other people, by their peculiar environment, that the first travelers among them to describe these strange details were looked upon as Munchausens of the greatest breadth of imagination. Houses of ice and snow, the very last thing in the world that a person would take to make a comfortable abode anywhere, were reputed to be their winter habitations.

They lived on raw frozen meat in a temperature where it would be agony to any one else not to have their meal hot and steaming; and so on through social economy, leading a perfect life of social paradoxes.

By most ethnologists it has been claimed that this strange nation found itself in its frigid land as a result of national weakness, "crowded to the wall" as it were by superior races, and that wall a wall of ceaseless ice. I am a firm believer in the opposite, or that the Esquimau finds in the North his most congenial clime, and we find to corroborate this the perfect contentment of the people with their country, their hesitation in leaving it for however short a visit, their longings to return when absent; many other reasons show that they are naturally natives of the north land by their own choice and not that of others. They are no more held to the rim of the cheerless Arctic Sea by other races than are the musk-oxen by the buffalo, or the polar bear by the grizzly. That they are more than satisfied with their cold country and its phenomenal low temperatures is amply shown, I think, in their preference for their winter life over that of the summer, although their struggle for an existence is much harder then, as viewed from our point of hardships, in the terrible exposure and oft recurring famines, for which they seem to care but little. Now let us take a look at that winter life in the light of one who has lived as an Esquimau for over two years among them, for every one will admit that some additional light is needed, so little do they have in the winter season.

A few premonitory frosts commence in the Artic fall, generally followed by a blustering northern storm of snow snd sleet, and then with a sharp snap the thermometer sinks to the minus twenties and thirties and the Arctic winter is upon them, and as the schoolboy dialect would have it, "for keeps too." This varied from early September to late October in my travels, occuring on King William's Land at the former time in 1879, and in North Hudson's Bay at the latter in 1878. This sudden onslaught of the winter does not drive them at once into their peculiar houses of snow, glad as they would be, however, to avail themselves of such an abode; for the first snows that fall are not of the right texture for this Arctic architecture. Fully forty degrees below zero must have been reached and a number of fierce gales must have "packed" down the autumn snow before it is of the proper consistency, or *sec-tu-u-ad-lo* (heavy) as the Esquimaux call it, to be cut into the curious blocks or huge bricks of snow with which they make their snow-house; (*igloo* of the Esquimaux) looking so much like the old-fashioned pictures of bee-hives with their oblate shape. Their skin tents are altogether too cold to live comfortable in them long before that time comes around, and the Arctic carpenter is driven to another curi-

ous material for building to keep out the bitter cold, and that is the pure ice from the many fresh-water lakes and ponds with which their country abounds. When about six inches thick they cut out slabs about the size of an ordinary house door, put them upright on their ends, joining them edge to edge, making a little circular pen of ice about ten to fifteen feet in diameter, over which they put the summer tent for a roof. These houses of ice are as transparent as glass, if clear ice has been formed, and when finished one can look through and see what his or her neighbors are doing without the trouble of getting down on his hands and knees and crawling in to find out. These glass-like houses thus completely kill all incentive to gossip, as an essential element thereto, ignorance of the person talked about, is wanting. I am pleased to add however, that the malicious variety of this trait is wholly unknown among these distant people.

The house of ice, while warmer than a skin tent, will not compare with one of snow, and as soon as this material is of proper texture, an *igloo* or snow house is constructed. I will not dwell on the construction of the *igloo* to any great extent, further than saying it is the shape of a half egg cut perpendicular to its axis, and about six to eight inches thick in the blocks, which are about thirty inches long by half as wide. The most common errors regarding the Esquimau snow-houses are, that these big blocks are laid flat, when they are really on their longer edge, and that they form one course above another, like we build a brick building, when in fact, there is but one course, spirally twisting around from bottom to top. While the blocks are but six to eight inches thick, the *igloo* is often made four to five or even eight to ten times as thick during very cold weather, by a banking of loose snow thrown over it.

Of course the temperature can not get above freezing in these homes of hard snow, or the structure will commence melting and eventually tumble in; but it must be remembered that a person can soon get used to a temperature just a few degrees below freezing, and even be quite comfortable. I must say that after a person has gotten thoroughly acclimated to the out-door winter life of the Arctic, a temperature of 20 deg. to 32 deg. Fahrenheit is every bit as comfortable as one of 70 deg. to 80 deg. to a person coming into the house from a temperature well below freezing. I distinctly remember one curious effect on the white men of my party during the cold of the first incoming winter. Every one has probably felt the loss of managing power in the fingers when numbed with cold, and inability to write or button or unbotton a coat or other garment, or anything requiring considerable manipulation and play of the fingers, and we, of course, were no exceptions to the rule at first. Being constantly in this temperature, however,

and almost as constantly exercising our fingers under these disadvantageous circumstances, I was greatly surprised to see how rapidly these functions of the fingers were restored, until by time the winter was over they were actually as perfect as ever in any temperature, however cold, and this too, despite the fact that there still remained, as before, the disagreeable sensation of cold in them at times. It seemed as if the motor and sensory nerves could be made absolutely independent of each other, and this benefit, which allowed me to thread a needle and sew below freezing, to use a sextant for observations at minus forty degrees Fahrenheit, or clean and insert cartridges in a magazine gun at even twenty degrees lower with ungloved hands, I believe I still, to a certain extent, retain, although all others accruing from Arctic acclimatization have disappeared in my five years away from that zone.

If a comfortable house made of ice or snow seems singular during intense cold, how absurd an enjoyable bed made of the same material must appear; and yet their bedsteads are made of snow, the mattresses of many layers of musk ox and Polar bear robes and undressed reindeer skins, while the sheets are dressed reindeer robes and the covers of the same material, their pillows being their reindeer clothing rolled in a bundle at the head of the snow bed. Here, stark naked, with only one reindeer skin over them, they will sleep as soundly as a farmer in more favored climes after a hard day's work, and that with the temperature out of doors so low that every breathing thing is enveloped in a cloud of its own making.

The amount of cold these northern nomads can endure, however, borders on the phenomenal. I have seen the little babies, two and three years old, perfectly naked, for hours at a time, on the reindeer robes of the bed in the *igloo*, the temperature, as I have said, being constantly below freezing; and in the fall I have seen them naked, playing and splashing in a pond of water, long needles of ice forming on the quiet place. I once saw an Esquimau baby boy taken from its mother's hood, and naked, made to stand on the snow until she found its reindeer skin clothing from the sledge, a fairly strong wind sufficient to drift the loose snow along with it, blowing at the time, the thermometer minus thirty-eight degrees, the only protection it had, being behind a sledge loaded about three feet high, around and over which the wind poured. Its exposure thus was a good minute, and to appreciate this one must take a watch in his hand, and see that length of time drag by, a time that a not unconscientious but sensational writer might readily jot down as five or ten minutes. And I have known a naked man, surprised asleep in his *igloo* by a polar bear, hastily grasp a gun and pursue his enemy two or three hundred yards in the snow, the ther-

mometer fifteen to twenty below zero, and slay him. These Esquimaux rub slushy snow, dipped in water, on the bottom of the runners of their sledges, with the open palms of the hands until it freezes into solid ice, the thermometer being from zero to seventy below, when I have known it to be done. I have seen an Esquimau throw himself on the snow and rest comfortably for half an hour, the thermometer seventy-one degrees below zero, or one hundred and three degrees below freezing; and probably doing some light work with ungloved hands. The Kinnepetoo Esquimaux who seldom build even the small fires of the native stone lamp in their *igloos* during the very coldest weather of winter, are probably the hardiest of all these boreal tribes in withstanding low temperatures, and sit around in their cold cheerless snow-houses with only their undergarments on (the Esquimau has two suits of reindeer skins, the outer with the hair turned outward, and the inner with the hair turned toward, and resting against the body) their arms withdrawn from their sleeves and resting on their bare bodies across their breast, chatting all the while pleasantly about various matters, the thermometer often being below zero; in fact, the only warmth the snow-house has is that given off by their bodies. I have known one of these Kinnepetoos to take an undressed reindeer hide that had been soaked in water, to remove the hair, which was frozen stiff as a plate of boiler iron, put the same against his naked body, and not only hold it there till it was thawed out, but until it was perfectly dry, so as to use it for a drumhead (*Kee-low-tee*) in their peculiar savage rites. In fact, I might say that I have been naked myself in a temperature of minus sixty-eight degrees, during the short time it took to undress, roll my reindeer coat into a bundle for a pillow, and crawl into my sleeping-bag; but my movements partook more of the character of a small boy going to a base-ball match than one sawing wood.

Their most efficient method of keeping warm seems to be in the enormous quantities of fat they devour, and especially during the winter season, and of which so much has been written that I will leave the subject for others not so well understood. Their clothing made of reindeer skins throughout, I have sufficiently, though very briefly, described above in brackets. Persons looking at pictures of polar people clad in these swarthy furs, think from their bulky appearanee that they must be quite heavy, but I think they are lighter than our winter suits at home. They are certainly lighter than any other clothing in the world called upon to protect their owners from such intense cold.

A most peculiar fallacy of Esquimaux winter life is that, when they are living in these odd little snow houses, and wrapped in furs and subsisting on fats, that their lives are a

sort of hibernation, as near as human beings can be supposed to hibernate. On the contrary, the very reverse seems to be the case, and it is by far their liveliest season, despite the fact that their days are much shorter, and all conditions, as we would view them, much more unfavorable for any great amount of active out-of-door-life. I do not believe I exaggerate when I say, that for every mile they travel in summer, with their *kiaks* (little skin canoes), or on foot over the land, they can show from a dozen to a score in the winter with their dogs and sledges. They kill more game in this season, and their long evenings are by far the most lively in their acrobatic and superstitious exercises.

A book could be written without exhausting the winter life in Esquimaux land, but I have tried, in my small space, to give some of the most interesting themes thereon, and above all something new and beyond the hackneyed subjects of other polar travelers.

THE STREAMS OF WESTERN KANSAS.

An inspection of the map of Kansas discloses the fact that the streams of the western part of the State are divisable into two systems. These are the northern, or Kansas river system, and the southern, or Arkansas river system. They are separated by a somewhat irregular line whose general course is east and west through the middle of the State.

Of the branches of the northern system, the Republican, the most northern branch, is a far larger stream than either the Solomon, the Saline or the Smoky. The most important of the smaller tributary streams of the north are also in the Republican region.

Of the southern system, the Arkansas river, after crossing the west line of the State, flows for about one hundred and fifty miles without a single living tributary, and, until after passing the middle of the State, it receives only three small streams, viz: Coon Creek, Pawnee Creek and Walnut Creek. Along the Indian Territory line, Western Kansas is drained by the Cimarron, a branch of the Arkansas, and its tributaries. The great number of these tributaries becomes strikingly noticeable about the one hundredth meridian, or the longitude of Dodge City; and from this east, the streams indicate an abundant water supply in our southern counties.

This distribution of the streams of Kansas leads naturally to the interence, if the inquiry be carried no farther, that the northern and southern portions of the western half of the State have better supplies of water than are accorded to the central belt.

An examination of the character-

istics of the water courses, and of the country they traverse, renders questionable the correctness of this assumption.

Turning to the streams of the southern system (I have not yet extended the inquiry minutely to the northern system), the Arkansas river may be taken as somewhat typical. It is a broad river, whose banks are from three to eight feet high, and whose waters run rapidly over and through a bed of course sand and gravel, the particles of which mix and roll with the muddy water. Where it leaves the Rocky Mountains, the Arkansas is a rushing torrent, which at all seasons discharges a considerable volume of water. Its fall in Kansas is from six to eight feet to the mile. Its course is nearly east until near the midde of the State, and then it is southeast. The depth of its gravelly bed is not known. Borings have been made at Sterling to a depth of about fifty feet, and it was found that the gravel became coarser as the boring proceeded; and at about fifty feet below the river-bed the sand-pump failed to work, being unable to receive and hold the coarse sand.

Throughout the Arkansas river valley, wells sunk to the level of the river bed reach the same character of gravel and an inexhaustible supply of water. When the Atchison, Topeka & Santa Fe Railroad track was laid along the upper Arkansas valley, the working force consisted of about three hundred men and two hundred and fifty horses. Camp was made at noon, and at night. The supply of water for these men and horses was obtained by driving down at the successive camping places a small gas pipe with a perforated point, and attaching a pump to the top. The depth from the road-bed to the water was, in most places, about six feet. The abundance of this water supply is further illustrated by the pumps of the sugar works at Sterling and Hutchison. The amount of water required for condensing the vapor from the vacuum pans is immense, and is supplied by powerful steam-pumps, working continuously day and night. The water raised by one such pump is about what would flow through a four-inch circular orifice under a head of one foot. To obtain this supply, a few perforated points are driven into the gravel and water beneath the soil, and connected with the suction-pipe of the pump; and they never fail to furnish an abundance of water.

In the southwestern counties, the country rises into an elevated table-land at varying distances from the Arkansas river. Wells are made in these high plains, by boring, as it is believed, to a level with the bed of the river, where gravel or sand and water are encountered very much as at a less depth in the valley. These borings reach the water in the country southwest of Dodge at a depth of about one hundred and ten feet. Exceptional places are found in which water has not been reached at a depth even of two hundred and fifty

feet. In these places, a dry clay, impervious to water, is encountered. Some wells have been bored through this clay, in which cases the water has risen to within one hundred and fifty feet of the surface. The question now arises. Does the Arkansas flow under the entire southwestern quarter of Kansas.

Now turn to the Cimarron river, two branches of which enter the State near the southwestern corner, and unite a short distance west of one hundred and first meridian. After uniting they disappear beneath the surface, and are seen no more for fifteen or twenty miles, and then reappear a larger stream than when they sunk away. In times of freshet the overground stream is continuous over all parts of its course.

Another stream, called by the old plainsmen White-woman Creek, enters the State in Greeley county, crosses Greeley and Wichita, and disappears about the middle of Scott county. It is stated that this stream flows over the surface during only a portion of the year. At no time, however, has it any visible outlet; unless, indeed, it may be considered the headwater of Walnut creek, which rises, an unfailing stream, in Lane, the county next east of that in which the White-woman disappears.

Other less conspicuous examples of disappearance of streams might be noted. Indeed the Arkansas itself has, in the central part of the State, several times, within the observation of the writer, become, to all appearance, a bed of dry and drifting sand. But an abundance of water was always found at a short distance below the surface.

It is stated that from the time Texas cattle were first driven over the trail to Dodge City, the coy-boys experienced difficulty in preventing stampedes at a point in the southern part of Ford county. Rumbling noises even are reported to have startled the bold cow-boys themselves. Subsequently, it is stated that a circular portion of earth, variously estimated at one hundred and fifty to three hundred feet in diameter, sunk, leaving a great hole down to the water's level, about one hundred feet below the surface. The water is intensely salty; and an enterprising settler has erected a windmill, and is pumping the salt water into troughs, from which the sun and wind carry away the water, allowing the salt to crystallize. Further east salt-springs and salt-streams become numerous; and in the Indian Territory, not far south of the Kansas line, are great salt plains of the Cimarron river. No direct investigation has yet been made to determine the existence of a current of water under this vast country. But every inquiry lends confirmation to the belief that a large portion of the moisture precipitated upon the eastern slope of the Rocky Mountains, together with that of the plains themselves, finds its way quickly through the porous soil to this preamble gravel, and through this proceeds slowly in a

broad, deep stream under the plains of Kansas. And before concluding that the middle belt of the western half of the State receives less rainfall than the country north and south of it, it will be well to compare the extremely open soils of the middle with those of the other parts; to make some geological comparisons; to ascertain whether the streams of the north and south may not be the springs fed by the rains of the middle portion; and, finally, to compare records of rainfall, when such records shall have been made.—*Prof. Cowgill.*

PNEUMONIA AND OZONE.

Since the beginning of this year there has been a severe and very fatal epiedmic of pneumonia in this city, from which many of our most eminent citizens have died. Several of the leading physicians have stated that the deathrate from pneumonia this year has been much larger than that of the cholera in the year 1854.

As so much solicitude has been felt and expressed by the doctors and by the public at this sudden increase of death from pneumonia, I have thought that it was desirable to undertake a systematic study of the bearing of meteorology upon it, and see if there could be detected any connection between the weather and this disease in the city of New York. On comparing many thousands of observations from the self-recording barometer, thermometers (dry, wet, and sun), hygrometer, anemometers, and pluviometer, with the mortuary statistics, there could not be found any continuous connection between these observations and the prevalence of pneumonia. But when ozone was taken into consideration, there was found to be a very close connection between its observations and the deathrate from this disease.

In the following table is given a summary of the deaths from pneumonia, the amount of ozone, and the number of days on which ozone occurred for the months of January, February, March, April and May for each year from 1878 to 1885 for the city of New York:

YEARS.	DEATHS.	OZONE.	NO. OF DAYS.
1878	1304	9.50	73
1879	1409	10.88	65
1880	1490	12.39	75
1881	1804	12.84	101
1882	2056	16.19	86
1883	2061	12.73	85
1884	1608	6.45	48
1885	2308	13.26	87

On an inspection of this table, it will be found that by the records of the Health Department of New York City there were for the first five months in the year 1878, 1304 deaths from pneumonia, while the observations at this observatory give 9.50 for ozone on 73 days for the same months. In 1882 the deathrate had increased to 2056 deaths, and the ozone to 16.19 on 86 days. In 1884 there was a decrease in the deathrate to

1608, and also in the ozone to 6.45 on 48 days. In 1885 the deathrate from pneumonia increased to 2308; the ozone had also increased to 13.26 on 87 days.

Having studied the observations thus far, the two following questions appeal to our attention.

(1) *What is ozone?* (2) *Can ozone produce pneumonia?*

For more than half a century scientists have been endeavoring to answer the first question. Some of them have called it "electricized oxygen," "allotropic oxygen," "active oxygen," "excited oxygen." Berzelius expressed the opinion that ozone was oxygen in a peculiar state. Becquerel demonstrated that oxygen may be converted into ozone by the prolonged action of electricity. By a majority of modern experimenters it has been admitted that ozone is an allotropic condition of oxygen, similar to that which may be assured by chlorine, as was shown by my father, the late Prof. John William Draper, M. D., of the New York University, and an account of which was published by him in a memoir entitled, "*Allotropism of Chlorine, or its passive and active states,*" in the year 1845. Ozone like Chlorine possesses powerful bleaching, disinfecting, and deodorizing qualities, and in a concentrated form both these gases are very destructive to animal life. According to Schonbein, oxygen is capable of assuming three different conditions, viz:—two contrary active states, and one passive. These have been named respectively ozone, antozone, and neutral oxygen. But why oxygen should assume its active or passive states little is known. My father found that the indigo rays of the solar spectrum could produce in chlorine the active condition. May not these same rays produce the corresponding state in oxygen?

In taking daily observations on ozone at this observatory, Schonbein's iodide of potassium and starch papers have been used, and also the iodide of calcium and starch papers. I have noticed that on some occasions, soon after the papers have been exposed to the atmosphere they change to a decided brown color, while after a few hours this brown color nearly disappears. On dipping the paper while still brown into water, the blue color of iodide of starch is given. This shows that antozone has been present in the atmosphere but has not had time to destroy entirely the ozone effects produced on the paper.

We come now to the consideration of the 2nd question, viz:

Can ozone produce pneumonia?

As to the causes of this disease, very little is known. Sometimes no cause at all can be traced. Very often it is supposed to be the consequence of exposure to cold, especially when the body has been previously heated by exercise. But why such exposure should in one person cause pneumonia, in a second, pleurisy, in a third pericarditis, and in a fourth, peritonitis we cannot tell.

If, as we have seen in considering the first question, oxygen has the power of assuming different forms, one of them preservative, another destructive, may it not in one or other of these forms produce inflamation of the substance of the lungs, etc., thereby causing their engorgement with blood not properly arterialized? I think it might be well for physicians in their treatment of pneumonia, or its allied diseases to consider whether these diseases may not be due to ozone or antozone, and whether it may not be possible to neutralize the evil effects of one form of oxygen, by the use of the other. The further question arises whether the administration of pure oxygen to patients may not be the very worst treatment. It is well known that the oxygen of the atmosphere is mixed with about four-fifths of nitrogen.

I regret to see that so many meteorologists neglect the taking of ozone observations, because they are not satisfied with the results obtained. I think that the day is not far distant when we shall know the exact influence of ozone upon disease, and if it should be discovered that in other cities, there is the same connection between ozone and the deathrate from pneumonia, and its allied diseases, as there seems to have been in this city for the past eight years, shall we not have made the first necessary step towards mitigating the evil results of this disease upon human life, as well as its disastrous effect upon cattle under the form of pleuro-pneumonia.

CONCERNING CLUBS.*

A club was man's first weapon. The stout cudgel with which the primitive man killed a bear for his dinner was not more essential to his existence, than was that association with his fellow savages by which he secured protection and support.

And, as States matured and became well organized, such associations, for the promotion of some common object, multiplied and broadened their sway, until they have at last found recognition as important factors of human progress.

In no way, perhaps, is our age more distinguished from those that are past, than by its higher appreciation and wider application of this principle of association.

So far has the work of organization and subdivision been carried, that there is no place without its clubs, and no work that is not done, or attempted by them.

Under high conditions the club becomes mainly social and intellectual in its character and aims.

An example of such a club, and a most beautiful one, is found among the ancient Greeks. Imagine the

*A paper read before the Social Science Club of Kansas and Western Missouri.

rapture of a noble Athenian boy when admitted to his first symposium. How proud is his step; how glow his cheeks; how throb his pulses; how flames his ambition to acquit himself worthily. One could willingly be counted 2,500 years old next birthday to have shared his transports.

In the Greek symposium the young student or statesman was met by questions that challenged his reason and sharpened his wit.

The rising poet and painter and philosopher were encouraged there to present each his best work or thought; and criticism, keen but kind, prepared him for contact with the world. There wit more sparkled than wine; and odes of Sappho, and ballads of Anacreon, the sweet-voiced lyre and sweet-eyed musicians, filled and thrilled the young heart with poetic fervor. Dainty viands and rare perfumes, and softened radiance of light and color, less than glorious paintings and perfect statues, warmed the imagination and entranced the senses. There the beauty of lofty thoughts, and the sublimity of great deeds fired the eager youth to highest endeavor.

Since those ambrosial days, the club has assumed all phases. The French Academy, at its palmiest, when only a back parlor circle of literary friends, and before it had to bear the oppressive honor of Richelieu's patronage, was the very perfection of a social and intellectual club. The conversational power and grace; the swift, keen wit; the perfect dignity and discipline, combined with sweetness and polished familiarity with which its half dozen members entertained each other, have since enchanted the whole world, and have constituted it an ideal to be longingly followed, if never quite attained.

In London, "The Club," as it was invariably called,—for its members would not stop to identify it by any distinctive title—the haunt of Johnson and Goldsmith, of Garrick, and Gibbon, and Sir Joshua Reynolds, was famous—how justly so, we all know. But it lacked that spirit and refinement which the presence of cultivated and gifted women alone can bestow. That it was denied their gracious influence, and that all clubs, after this time, gravitated toward social and even animal enjoyment, to the neglect of the intellectual, was a misfortune for which Johnson must bear somewhat of blame.

"A club," said Johnson, "is an assembly of good fellows meeting under certain conditions." And other good fellows, accepting this vague definition, allowed the conditions to become more and more uncertain, until good-fellowship was the only point left worth insisting upon.

Of the fifty and more clubs which sprang up in London about this time, those where good things were said—not merely swallowed—became exceedingly rare.

These were all gentlemen's clubs, in the sense that no ladies were ad-

mitted, and had their fitting place in coffee houses and taverns. Such of them as are still extant, have improved in many ways. These occupy imposing buildings, and possess every convenience and luxury of a perfectly appointed home, including valuable libraries.

Clubs after this model are found in all our larger cities; but they have never become quite popular.

The American gentleman is more domestic than the English, and not so culpable.

In so far as these, or any clubs, undertake to furnish amusement for men or women, apart from their families, and from each other, and to fill up those leisure hours which should be given to the home, they aim a blow directly at the unity of the family, and are vicious in their tendencies. But these tendencies are so remote from us as scarcely to merit a passing allusion.

Among us, intellectual society inclines to the formation of study clubs, that is, of regularly organized companies, meeting at stated times, for associated study and criticism. These study clubs, though never so sharply defined but that each shows a shading of the other, and many show a blending throughout, are yet clearly divided, by the dominant motive, into two types. In clubs of the first type, the main object is individual culture; in those of the second, it is public improvement.

An association of the first type, and one that is almost purely individual in its work, is the "Society to Encourage Study at Home," or the "Boston Home Course." The name of this woman's club expresses its aim. It wishes to supersede desultory reading with systematic study; to give to girls and woman an opportunity to complete at home an unfinished education. And it offers them a course of instruction which is broad and deep, as well as elegant. The monthly examinations, conducted by correspondence, are critical, and even severe; but these are accompanied by suggestions so full of kindness and wisdom that the student is encouraged to persevere.

This Boston home course begins its thirteenth year with widening influence, and with increased opportunities for doing good. More than 200 teachers are engaged in the work, all volunteers; and its students found in every state in the union, number many hundreds. Not less than 12,000 letters pass between these teachers and pupils every year. The club possesses an extensive loan library, also, to which additions are canstantly being made.

One other good thing it does; it sends to each student a health tract —preaching the responsibility of woman, not only for their own health, but for the health of the home, and encouraging household work as a proper balance to intellectual work.

The Chautauqua movement, with its classes of 800 in Japan, its branches in South Africa, and its circles in every city and hamlet of our

country—is phenomenal. One hundred thousand students are, this year, counted in its ranks, and more than 1,000 have already graduated. Nothing could be more significant of the widespread appetite for culture than such a success for such an enterprise. It is one of the most promising signs of the times, one of the strongest of many hints of the democratic tendency of learning, and of the insufficiency of the old time methods of college and university to teach the masses.

The Chautauqua course of study has been much criticised; it has been called superficial and pretentious; and is charged with making literary upstarts rather than hard workers and deep thinkers. And some of its text books are perhaps compilations suited for hasty rather than thorough work. But to the multitudes who must do hasty work or none at all, it gives that outline acquaintance with the world of letters and the wonders of science which makes them at least appreciative readers and listeners. Much smattering, it may be argued, is far beneath a little real education. But among the ever increasing myriads of things which it were good to know, we sometimes feel like admitting, with Gail Hamilton, that we would be thankful to be "well smattered."

It is undoubtedly true, also, that many who would hesitate to attempt a more exacting course, acquire, by means of this, a taste for knowledge which ultimately leads them into deeper study. The *Chautauqua Press*, of Boston, is constantly issuing works prepared expressly to meet the wants of the club; and its late productions —notably those in the departments of literature and natural science— show marked improvement. Its late appointments, also, show its more liberal tendency and the great Chautauqua flood, as it grows wider and deeper, is submerging its old narrow land marks, and sweeping away old superstitions.

The smaller study clubs which everywhere abound, and in which many of us are personally interested, are all of this first type,—being chiefly concerned with the intellectual pleasures and advancement of their individual members.

The Concord school of philosophy —a study club, in a wide sense— should be, it would seem, a perfect example ot the first type, since its aim is purely philosophical.

But speculative philosophy gasps for breath in the material atmosphere of the nineteenth century; and the modern school of Athens, with Emerson as its Socrates—Emerson, "the fire of whose genius was love for humanity," finds that it is philosophy as applied to the problems of life, that compels its profoundest research.

If it would found an American school of philosophy, it must make that philosophy practical; it must be the doctrine of life, the art of living nobly and well. It must send to the nursery better mothers; to the

schools and colleges better teachers; to the government offices better statesmen; and to the pulpit better interpreters of the sacred book.

This is its declared purpose, and to it we all respond, amen! and may the seven years of our Concord school of philosophy be prolonged to seventy times seven.

Sorosis, the pioneer woman's club of America,—17 years old last March—had, as its first and only ostensible object, the promotion of useful and pleasent relations between women of literary tastes. But those brave, earnest, strong-souled and strong-minded women, who made the early Sorosis what it was,—Frances Power Cobb, Alice and Phœbe Carey, Emily Faithful, Lucretia Mott, and others possessed a gift of helpfulness which mortgaged them to all humanity.

There was healing in the hem of their garments; the multitudes pressed upon them, and would not be kept back. Their own large-heartedness, also, forced them to supplement more purely literary work with the discussion of the proper field for work for women; the best way to aid women; plans for labor schools; the moral, as well as mental education of girls; homes for unfortunate women; foundling hospitals, and hosts of kindred subjects. These discussions opened the way to wider fields of usefulness, and to a higher, grander womanhood for the whole sex.

The organizations claiming Sorosis as their parent are many and helpful. And we, who are here to-day, have somewhat for which to thank Sorosis, in that we, as women, are growing stronger, braver, freer, more noble, more patient, and more womanly.

The second type—the club whose aim is wholly beneficent—has many glorious representatives. They are devoted to the discussion of subjects of the first importance—political, economic, social, ethical and philanthropic, and represent the most earnest, thoughtful, and progressive element of our age and country.

Such is the American Social Science association, which this year celebrated its twentieth birthday. Among the members of this great club, are many who are workers also in one or more of the associations already mentioned—men and women whose names are household words to us; and many others who have done valiant work in its ranks, have gone beyond. One of its earliest members was General Grant; that good citizen, who hated the deadly art by which he rose to fame; who sought neither dominion nor glory, but peace alone, and the welfare of mankind. The introduction of definite instruction in the social sciences into so many American colleges and universities is directly due to the efforts of this association. At Williams college, at the University of Michigan, at Harvard and Cornell social studies are being pursued with surprising zeal and thoroughness. This is matter for rejoicing to all who realize how vital is the necessity that the studies of our young

men and women should bear more strongly on the problems of American life.

The American Social Science association, with its many branches, the Society for Ethical Culture with its many branches, and kindred organizations which are springing up everywhere, down to our own Social Science club of Kansas and western Missouri, which, if it has not many branches, has many and deep roots, these form one band of workers, hand-fasted in a common cause—the good of humanity—setting themselves to study the facts and laws of the social order without prejudice or bias of any sort; aiming ever at the prevention of evil, rather than at its cure; striving patiently to learn what is, and to promote what ought to be.

In our strong, forth-putting, irrepressible, young American life, where bold and bolder investigations are constantly being made in every department of knowledge, new social and moral problems are every day confronting us.

Crime and the treatment of criminals, pauperism and practical charity, the elevation of the working classes, temperance, sanitary science, the adulteration of food, work and women, the just relation of the sexes, duties of parents and children, these, and other questions are pressing for answers.

It may be that our club stands at the foot, the youngest and weakest member of the great national class in the science of society; but not for this reason shall we escape our share of the responsibility. Many of the questions are peculiarly our province because we are women, and it is our sisters who ask. We must answer the young mother who sits at home, rocking her babe upon her breast, and turning wide, glad eyes to us for guidance. And that other mother whose streaming eyes and shaking hands implore our aid in winning back a wayward one. There are vaguely dissatisfied souls—useless, but yearning to be of use—to be turned into paths of unselfish helpfulness, and everywhere, discordant hearts to be attuned to harmony, and inspired with a loving enthusiasm for all that is good, and true, and beautiful. For our encouragement, we may remind each other of the successes of other women. The recent Woman's Congress at Des Moines, and the Woman's suffrage association at Minneapolis, have breathed inspiration through the whole country. And, at the anniversary of the American Social Science association, the most salient and incisive discourses, those that awakened the deepest interest and most thorough discussion, were given by our clear-headed, great-hearted, public-spirited women. God bless them!

Since these discussions are forced upon us, how best can the work be done?

First of all, by keeping ourselves as a club in the best running order.

We possess one requisite of success

in that we began small, and have attained to our present proportions by a natural growth. A rapid growth, truly, from the original twenty to the present 375 members, in the four and a half years of our existence, but still a growth that is vigorous and healthy. Another promise of success is that we are perfect in harmony; and still another that we appreciate the importance of the work before us, and are earnest to give our best selves to its accomplishment.

Every member is here responsible, not only for the assigned duty, but for the general harmony and interest. A full realization of this responsibility fosters enthusiasm, without which there is no grand success.

It were well if we were content to make haste slowly. Better for us, surely, is one subject carefully presented and thoroughly discussed, than a passing glance at many. We praise this paper, and that, as "so suggestive;" but what use do we make of these good suggestions? Theoretically we go home with our tablets full of them; theoretically we study them all toilfully, and apply them all conscientiously. Practically they are dropped, with a sigh, into the great mental waste basket where all good suggestions go. We are everywhere haunted with the reproachful ghosts of good suggestions; and must we here increase that grisley throng? Why not do the little that we can, thoroughly and well? that we may carry away, not the shadow, but the substance of things hoped for.

A high sense of honor requires, in a club, a deep subsoil cultivation, that its early-ripe fruit may be a fine scorn for anything like the shirking of a responsibility, great or small. One woman possessed of inflexible integrity and reliability is of more value than many geniuses. All may not realize the power of those homely, old fashioned virtues, patience, perseverence, and promptitude; but, verily, the executive committee knoweth that their price is above rubies.

A degree of moral hardihood is also a goodly possession, so much as suffices to the utterance of any honest thought. Also a little—just a little—callousness to criticism.

We may have confidence, always, to speak our best thoughts. It is a God that dwells within, and all should do it reverence. Reticence is a thing to learn as well as eloquence. After reticence, comes calmness, and patience, and tact, and unfailing kindness. Also, respect for individuality, sympathy with all honest endeavor, however crude; and triumph in each other's success.

Such clubs as ours, are, as they should be, free from all thought of caste. It is not to be believed that the accident of position ever affected the status of any one here, where all meet with a common interest in the common good.

Many a soul, shut in by circumstances, or by its own sensitiveness, longs for such sympathy and companionship as we here enjoy. If our

club does in any measure broaden and sweeten life for one of these, or if it sends one weary soul upon its way, once more glad, and strong, and patient, it has given a fair excuse for being.

Finally, let us begin and end with faith—faith in ourselves, faith in each other, and faith in the advancing, wide-sweeping, uplifting wave of a better civilization.

So shall we study the science of society with the earnestness of hearts consecrated to the work; gaining ever a fuller appreciation of life and its duties, staunch ever to the fealty that we owe to each other, to our sex, and to the world; growing ever into a closer sisterhood, and a more perfect womanhood.

EDITORIAL.

CONTEMPORARY FICTION.

The literature of our day is something entirely *sui generis*. The historian, the biographer, the essayist, even the poet, as well as more didactic publicists, write for an audience very different in education and in activities from that addressed by writers of the last, or even of the first part of this, generation. Historians must present something else besides chronicles of battles, policies and national achievements; they must display a knowledge of the social forces which underlie events and be prepared to square their speculations with the generalizations of modern science. It is the same with the others. What is it that gave Tennyson's "In Memoriam" such triumphant popularity? Obviously, as a mere elegy, it would have dropped into the limbo that such poetry usually reaches and merits; but strung upon the light theme of private grief, like pearls upon a worthless thread, Tennyson presented the generalizations of science transfigured into poetry. Probably no essayist of the day surpasses Mathew Arnold in celebrity; but, despite the beauties of his style, the chief value of his productions lies in the fact that his ideas are in harmony with prevailing scientific views. As for political economists, social theorists, even homiletical writers, they must conform to the current of scientific opinion also, or else see their pages go back to the paper mills.

The chief requirement of the modern reading public (I mean the enlightened, informed public) is, that the books it is asked to read must have plot, theme, moral, all subservient to some phase of sociology, psychology or other scientific generalization. It cares little about the matters so dear to the hearts of our fathers.

It cannot be supposed that fiction would remain unaffected by a motive so universal in its influence. On the contrary, it is profoundly affected by it. The novels of George Elliot, of Henry James, of Alphonse Daudet, are not only different in degree, they are different in kind, from the novels of Dickens, of Hawthorne, of Victor Hugo. They are, as to these, what the comparative-anatomist is to the empirical physiologist, What does it matter whether the book ends with a marriage or not, whether or no vice is punished or virtue rewarded? The author knows that these features are adventitious, and, whatever he may conclude to do about them, the result of his work must stand the test of scientific appraisement.

Yet it does seem that style should not be entirely forgotten, that the charm of a refined and elevated rhetoric should not be entirely sacrificed to the supposed requirements of scientific precision. In truth our foremost writers of fiction are guilty, not alone of this

fault but of one of much worse tendency in its effect upon the future of letters. This is euphuism—a rude, rustic fault that one would expect to see confined to the hastily prepared columns of the daily newspaper. As an instance, take the installment of "The Princess Casamassima, in the November *Atlantic*. One would scarcely expect to read the following from Henry James: "Peter Muniment took a match out of his pocket and lighted it on the sole of shoe; after which he *applied* it to a tallow candle which stood in a tin *receptacle* on the low mantle-shelf. This enabled Hyacinth to *perceive* a narrow bed, etc., etc. "Several months after Hyacinth had made the acquaintance of Paul Muniment, Millicent Henning *remarked* to him that it was high time he should take her to some place of amusement." * * "She tossed her head and *remarked*, that when a young lady had done" etc., etc. Of course the match was applied to the candle, if it was lighted—but what was the use of going this bold and round-about way to say that Peter Muniment lit a candle? Why, too, say *receptacle*? The receptacle might have been a tin cup or a tin can, or a tin pie-plate, and surely there was no need of mentioning the fact at all if the picture of the candle was to be left so confused in our minds. Why not say it was in a tin *candle-stick*? The word may be vulgar and common, but certainly not more so than *receptacle* seems to be as it is used. Why, again, should Hyacynth *perceive* so long as we have a verb to see? If Miss Henning had *said* the words put in her mouth instead of *remarking* them, no doubt they would have been quite as interesting and characteristic.

This fault seems to be deep-seated in Henry James' manner of writing—it is hardly a style; and it is a strong voucher of his strength and genius that, in spite of such a grave blemish, he has taken such an exalted position in the ranks of novelists. While he remains true to the painstaking, scientific method of constructing his stories, his writings would gain vastly in strength and beauty, if such school-boy phrases were omitted from his books.

A CRITIC CRITICIZED.

It is sometimes amusing to come across instances of misapplied wisdom —wisdom so oracular and consequential that we are reminded by it of the homiletic discourses of the learned and valiant Hudibras. An example of this kind of wisdom appears in an editorial in a late number of the *Popular Science Monthly* under the title "Party Government." The inspiring cause of this effort seems to have been a sentiment uttered by Senator Hawley, of Connecticut, during a recent address; this sentiment is as follows: "It would be a lamentable day indeed for this country, or any other enjoying a free government, when it could be said that there were no parties—that lovely time that some long for, when there should not be enough of moral or intellectual life among the people to get up a single difference of opinion upon political affairs."

At this the *Monthly* inflates its learned nostrils, curls its intellectual lip and wrinkles its superior brow with indigna-

tion. Agreement in truth, it cries, is the supreme end, and Senator Hawley must be a very wicked partisan, a vicious and selfish agitator, a grovelling office seeker and political adventurer, if he thinks political disagreement a useful factor in governing men!

Now what nonsense this is and how unjust the aspersions upon the motives of a man who is, beyond cavil, a pure and honest patriot. Who doubts that the end of honest discussion is truth? that is, relative truth. None but the most enthusiastic and self-satisfied sciolist will assert that a single principle in natural science is settled into an axiom; we can only say that the tendency of thought and experience is in a certain direction and, therefore, we believe *that* to be the direction toward which our investigations and theories must tend in search of truth. Whether or not there will ever be a time when the so-called generalizations of science shall no longer be attacked or defended, is a matter of speculation; what we do know is that every useful application of these generalizations must come through the fire and shock of discussion.

But the absurdity of expecting an utopian age for politics, when all discussion shall end and the whole community settle down into universal agreement on all questions of political science, is too palpable for argument. It will be a millenium indeed when the lion of republicanism shall lie down with the lamb of democracy, and all the other *itions* and *isms* and *cracys* swallow each other, so that there shall be no more discussion, no more disagreement, no more change of opinion, no further increment to political knowledge.

If politics were a science at all it would be a science of expediency. What is expedience? must always be the prime question in politics. Whether the protectionist or the free-trader; the greenbacker or the specie-maniac; the monometalist or the bimetalist; all appeal alike to the selfish propensities of human nature. If these propensities were all governed by the same pursuits and passions, it might be possible to adjust them under one general principle; but so long as men's activities are directed into diverse and adverse channels, it is silly to dream of a time when one policy will suffice for a whole community, and men cease to wrangle over forms and policies of government.

This being so, the uses of conflict and discussion are manifest. What is expedient does not become palpable at first acquaintance. Indeed no other question is surrounded with more difficulties and perils. Even those who are most glib in formulating sociological doctrines are the least able to put successful schemes of government into operation; as witness the failure of John Locke with the Georgia colonists, and the more recent fiasco of Thomas Hughes in Tennessee—setting aside the Brook-farmers. There can be no cast-iron rules, no unchangeable regulations, because human society is never stationary, and every advance or retrogression, or change of aspect, must be taken account of in political science. This involves discussion. If it were possible to conceive of a state of human society so perfectly developed that no

further change could occur,—a time when every individual will think and act precisely like every other individual—there would be also presented the spectacle of stagnation, decay and death.

Thus Mr. Hawley's sentiment, so far from branding him as an incendiary villain, thirsting for office and political triumph, really states a just and useful maxim. Whatever exceptions may be taken to the form of his statement, historical science places it beyond a doubt that discussion and progress walk hand in hand; while the closer mankind approaches to agreement on great subjects, we can confidently look for stagnation and dissolution. The Roman church, having the same opinion as the *Monthly*, sought to make all men of one opinion several centuries ago and the result was the Dark Ages. Let us hope that no such *doctrinaire* notions will ever again plunge civilization into a Slough of Despond so difficult to escape from.

A FEW OBSERVATIONS.

It is quite excusable in the promotor of a magazine, as it is in the projector of a railway, or a bank, or a barber-shop, to make public the testimonials and recognition his venture receives from those most capable of judging its merits. The REVIEW has certainly received its full share of praise and notice from press and public. Beginning with the London *Journal of Science*, our exchanges have vied with each other in the kindly rivalry of encouragement and good will. In the above mentioned periodical for November, there is a notice of the REVIEW, over two pages in length, presenting its merits and calling attention to the varied and interesting character of its contents. In another place the same magazine urges the people of *Kansas* not to let the REVIEW fail for want of patronage. This is all very pleasant coming from such a far-distant source, without friendship or self-interest to prompt it, and we hope the citizens of Kansas will profit by it.

Another very kind notice comes from Dr. Bowers, of the *Pacific Science Monthly* and *Ventura Free-Press* (California); another from the *Iron Trade Review;* another from the *Jefferson City Tribune;* another from the *Photographic Times;* all influential periodicals.

Prof. Otis T. Mason, in the *American Naturalist*, speaks of the REVIEW as "one of our best sources of information respecting the Archaeology of the Missouri region," and regrets very much to hear that there is danger of its discontinuance. Similar sentiments are expressed by Prof. Romyn Hitchcock of Washington, D. C., Prof. T. Berry Smith of Glasgow, Mo., Prof. Popenoe of Manhattan, Kas., Mr. C. E. Putnam of Davenport, Io., (Prest. Acad. of Sc.) and many other eminent authors and scientists.

Perhaps one of the most cordial endorsements the REVIEW has received, appeared in a recent number of the *Missouri School Journal*, an admirable and ably conducted paper; for the REVIEW is commended by it as "one of the best magazines published." This endorsement is doubly grateful on account of the high standing of the *Journal* and its freedom from the vice of

awarding honor when it is not due.

The editorial head is far from being turned, however, by these evidences of his success. The gratification of personal vanity is very poor pay for the labors and expense of publishing a magazine of the size and pretensions of the REVIEW; and while this moral support is pleasant to the heart it is unsatisfying to the pocket-book.

During the ensuing year, we intend to keep the REVIEW up to its present standard at least. If it is possible to increase its sphere of usefulness and interest we will do so. If it has to die it shall go down with colors flying and not meanly dwindle into insignificance.

NOTA BENE.

The patrons of the REVIEW, are respectfully requested to send in the amount of their subscriptions to the present volume, (Vol. IX), that is, those who have not done so. It is requisite that this should be done early, as the publication of a magazine in Kansas City is not, *per se*, a means of gaining an independent fortune. Once for all we must confess that if our object in continuing the REVIEW had been a mercenary one, there would be little encouragement to go on with the work. This however, was not the object. We desired to keep alive an enterprise which will grow, with increase of time and growth of public spirit, into something admirable enough to deserve financial, as well as moral support. Of the latter it has had full measure—in fact there is scarcely a day that does not bring letters commending the REVIEW, and urging us not to weary in well doing.

We do not wish to gather laurels or gold in the endeavor, but while we devote much time and toil in the venture, it is only fair that the public should help us by subscribing for the REVIEW. We will vouch to parents that its contents will be more interesting and valuable to the young, than any book that can be purchased for the subscription price.

OUR religious exchanges are full of controversy over the aspect the church should present toward evolution. It seems that professors in several southern theological seminaries have been teaching doctrines closely approaching Darwinism and, in consequence, have found anything but "ways of pleasantness" and "paths of peace" among their respective brethren. Science and religion should be mutual helpers, and it is absurd in this age to keep up the world-old conflict between creeds and progress. Let us all admit that truth cannot suffer, in any event, by discussion, and that intolerance is the most formidable barrier between us and knowledge.

A SOCIETY for Psychical Research has been organized in Kansas City, of which Mr. James Scammon is president. The committees have been appointed and are engaged in pursuing the lines of investigation suggested by the experience of the various societies in England and the United States, formed during the past two years. It is also intimated that a Theosophical Society will soon be organized. Thus, Kansas City has at last been reached by the wave of Occultism.

CORRESPONDENCE.

EDITOR KANSAS CITY REVIEW:

Originality is not the vice that affects most writers. But in the Kansas City REVIEW for October and November, Mr. Nathan Kouns, has contradicted Herbert Spencer, in an article wonderfully original, both in manner and matter. He very strikingly declares that Augustine, Calvin and Spencer have committed the grave error of supposing that the law of cause and effect applies to the moral nature of man. The repetition of this old error by the last named gentleman, is much "more pitiable and inexcusable" than its original expression, because Spencer "seeks to bind moral or spiritual truths by physical laws." This is not merely original; it is admirably clear. Everybody knows at once what is meant by this statement. A physical law is a relation of co-existence—or it is a relation of sequence. Now, Mr. Kouns means to say that Mr. Spencer seeks to make a moral or a spiritual truth exist along with something else, or in consequence of the prior existence of something else. It is very "pitiable and inexcusable" in Mr. Spencer to seek to do this, and it is absurdly unscientific. It is true enough that when courts inquire into the commission of crime, they very foolishly regard the motive or cause of the act as quite important; but courts are not scientific. It is also true that all people in all ordinary judgments, about all sorts of actions, think that the impelling cause of the action determines its moral quality; but common men are not scientific. It is true that parents transmit to their children their passions, their weaknesses,their virtues, their moral and their intellectual characteristics, just as they transmit features, complexion and constitution; but parents are not scientific. It is true that the Hindoo is morally a Hindoo; that the Bushman is morally a Bushman; and that the enlightened European is morally on a very much higher plane than the Hindoo, who is on a much higher plane than the Bushman. But these are very unscientific facts, and therefore so much the worse for the facts. It is unscientific to hold that the European is broad minded and kind hearted, because of co-existences, or sequences in his surroundings, or to hold that the Bushman is a mean, degraded, cruel savage, because of his training, his ancestry or his surroundings. Moral characteristics do not depend on the laws of cause and effect, but on will, says the scientific Mr. Kouns. Calvin did not burn Servetus because his age and education had trained him to bigotry and intolerance,and the fact that nine-tenths of his contemporaries were not horror struck at the act, but regarded it as quite reasonable, is wholly unaccountable. The wills of those folks were fearfully perverted, but were entirely free. To inquire why they willed such bloody murders for religion's sake, is unscientific, "a pitiable and inexcusable error," "utterly unscientific."

Not only is Mr. Kouns wonderfully original in fundamental principles, but he is equally distinguished with a famous teacher of old, as one who "speaks with authority, and not as the Scribes and Pharisees." Columns of alleged facts disappear when Mr. Kouns announces that they are "utterly false in fact." It becomes "absolutely certain that the first necessary work of a soul when quickened by conjunction with a spirit, is to begin the work of erecting a natural body for itself" on the unsupported word of Mr. Kouns. By a statement it is settled that the original primitive faith of the ages when men used stone hatchets and dwelt in caves, "was a purer theism than any existing religion teaches." And this proposition being so scientifically established the conclusion is drawn that it must have been a "Divine Revelation." Originality crops out strongly in the nature of this primitive God of Mr. Kouns' construction. He was a dual God—a male and female God—a hermaphrodite God. And to keep up his originality to the end of the chapter the writer asserts "that the Revealed Religion was never designed for anything but the temporal salvation of mankind;" that it has not a word in it about "immortality," the life to come," or "a future state of rewards and punishments;" that it is "Faith plus Communism, the only true democracy." Verily we have a Prophet in our midst, and we will do well to hearken unto him. His message is such as never before was heard in this world, and it completely refutes the old law of Solomon, that there is nothing new under the sun. Here is news both to Agnostics, who do not know beyond experience, and to the innumerable sects who fill the churches of Buddha, Mohammed, and Christ with praise and prayer to their various Deity.

Yours Truly,

M. CAMPBELL.

SCIENTIFIC AND INDUSTRIAL NOTES.

THE KANSAS ACADEMY OF SCIENCE.

The Kansas Academy of Science has just closed a most successful meeting, both in the number and character of the papers read and in the number of visiting members present.

The first meeting of the Academy held at Manhattan was the fifth annual meeting, in 1872, the one just closed being the second held in this place. The members present at both meetings were few, but four being found. Three of those prominent at the meeting in 1872, General Fraser, then President of the Academy, and Professors Mudge and Bardwell, have since died; while others have long ago left the State. In spite of the loss of members by death or removal, the Academy gains rapidly by accessions from the ranks of young men, college students and others, till now it stands in the most prosperous stage of its existence, as evinced by the interest taken in the meetings by members and visitors. It is impossible to do justice to the programme of over forty titles within the limits of one article; and we shall not attempt to mention even all those of importance. The following are taken at random, as indicating the general scope and interest of the entire list of papers presented:—

The discovery of a fossil bird track in the

Dakota sandstone, by Prof. Snow, considerably extends the geological limits of bird life. The specimen is unmistakably a bird track, the peculiarities of the foot being shown distinctly in the impression, the relations of the several parts of the track precluding any other origin.

In his studies on rainfall in Kansas, Professor Lovewell finds that, in considering the records by five-year periods, some of these periods which occurred during the earlier years of the record, had a larger rainfall than any other period of later date. He considers the conclusion to the effect that the rainfall has been permanently increased, which some have drawn from Professor Snow's paper of last year, as being without sufficient foundation. It should be remembered, however, that Professor Snow claimed only that the record already made shows an excess of rainfall during the last half of the period over that of the first half, amounting to several inches per annum.

Mr. Knaus' observations upon the Cedar Bark Beetle, Phlœosinus dentatus Say, have a practical interest to every planter of the red cedar or the aborvitæ in Kansas. The range of this insect is considerable; but so far as observed, the species is not found in Kansas, save as introduced in cedar posts from Arkansas or Michigan. Its attacks upon trees in Kansas are found to be made chiefly in the vicinity of lumber yards, where, on investigation, the species is found, as stated, in imported cedar posts. Mr. Knaus records the presence of a parasitic ichneumon fly, which will doubtless tend to render the propagation and spread of the species less possible in our State.

In his paper, Professor Sayre discussed the subject of Digestive Ferments, giving especial attention to pepsin and pancreatin, —the nature of these substances and the method of their preparation. As to the nature of these principles, the author seemed to indicate that the more light there was thrown upon the subject, the more complicated it seemed. The further investigation of it unquestionably will be not only of scientific interest, but of great importance to medicine and suffering humanity.

Messrs. Willard and Failyer presented the description of a new extraction apparatus, devised by themselves, and showed a simple instrument made after their plans. The device gets its great recommendation in its greater simplicity, and in the absence of corks, wires, and other unmanageable attachments, and in the consequent greater ease of handling and greater precision of results.

Professor Lovewell's paper on Methods of Illustrating Wave Motion, and the paper upon some Lissajou's figures in three dimensions, by Messrs. Nichols and Franklin, describe, directly or incidentally, class-room apparatus of simple and cheap construction for the illustration of some interesting questions in physics.

The first evening was occupied by the retiring President, Dr. Brown, who discussed in both the scientific and the practical aspects, the subject of Natural Gas, its occurrence, and the methods of utilizing it. The second evening of the session was occupied by Professor Nichols, whose subject was the Magic Lantern. After describing the origin of the magic lantern, and its development from a mere toy of the conjuror to an instrument of wide usefulness in science, the lecturer showed its applications in the illustration of science by means of photographic slides, and by various chemical, magnetic and optical experiments.

The third evening of the session was given to a social gathering at the College, where the visiting and local members, aided by memb rs of the College Faculty, discussed the practical side of the important topic, Science in the Kitchen, as presented by Mrs. Kedzie, the teacher of household economy, assisted by the young ladies of the fourth-year class.

The officers elected to serve for the ensuing year are: E. D. Nichols, President; J. D. Parker and N. S. Goss, Vice-Presidents; I. D. Graham, Treasurer; E. A. Popenoe, Secretary; F. W. Cragin, Librarian. In response to an invation by the Emporia members, that city was voted the place of next meeting, in November, 1886.—Prof. Popenoe, in Indust.

MOLDS.

All the forms of plant life—the yeast-plant, the protococcus, the diatoms and desmids and the bacteria—consist of single simple cells, and so are called unicellular plants. Now all plants, no matter how large they are when they have attained their full size, are, in the beginning, unicellular. It is by the repeated division and sub-division of this original cell that the full-grown plant is built up. As the cells go on multiplying in this way, they undergo differentiation—that is to say, they become separated into groups, each of which has special characters adapting it for a particular function in the life of the plant. Thus, some cells go to form the bark, others the wood-tissue, etc.

It will be interesting to take one of the simpler many-celled plants and trace out the stops of its growth from the time it consists of a single cell, to the time when it has attained its full growth, and is made up of many cells. Let us take for this purpose one of the molds, Penicillium glaucum. The molds, with the appearance of which to the naked eye as white or greenish patches forming on dead organic matter in damp places everybody is familiar, belong to the larger group of plants called fungi. The species of mold we are now to consider, may readily be cultivated for examination, by making a paste of flour and water, and allowing it to stand exposed to the air for a few days. The first appearance of the mold is a slight whitish opacity at the surface of the liquid, and close examination would show little elevations at these places. These patches rapidly extend, and become more opaque, and in three or four days take on a bluish-green look at the center. The whole mass now seems to float on the liquid. After a while it acquires a more decided green color, the coloring appearing first at the center and radiating outward. If now one blows upon it, a cloud of green dust will be seen; this dust is made up of spores.

Under the microscope, one of these spores is seen to be a spherical body, one three-thousandth of an inch in diameter, and consisting of a bit of fluid protoplasm, invested by a more dense and tough sac. If one of the spores that has fallen into the liquid paste be watched, a change in its appearance will soon be seen to occur. The spore grows larger, its liquid contents become granular, and in three or four hours there is protrusion of the cell-sac. This protrusion soon becomes an elongated process, and gives off branches from its sides. Just before the places of branching, cross-partitions are formed, and so the plant has now come to consist not of a single cell, but of several cells united. Meanwhile, other processes have been growing out from the spore and giving off branches, and after a time they become intertwined with one another and with those from other spores, and thus a delicate white film forms on the surface of the paste. This film is called a mycilium, and the separate branches of which it is made, hyphæ.

Examining a single one of these hyphæ, it will be seen that it is separated by cross-partitions into chambers. Each of these chambers constitutes a perfect cell; each consists of a liquid inner part and a surrounding tough, transparent envelope. Usually the inner part has four or five clear spots in it, called vacuoles.

For sometime all the hyphæ lie parallel to the surface, but after a while a few may be seen to hang down in the liquid. These are called submerged hyphæ. Soon after, other hyphæ grow up into the air, and it is then that the mold begins to take on its green color. These erect hyphæ are at first like the others, but by-and-by become modified. They give off branches both at their sides and ends. The latter, or terminal branches, next become pointed, and these points swell out into balls; the necks of the balls then enlongate, swell, and so form other balls, and this process is continued until a row of six or eight of them is produced. Now, each of these balls is a spore; as soon as it has become ripened, it falls from the hyphæ to the surface of the liquid, and gives rise to a new plant. Of course it often happens that a spore is carried off by

a current of air, and the matter of its living or dying depend upon the kind of material upon which it chances to fall. If it falls upon some organic matter from which it can get food for its growth, it becomes a new plant; if not, it dies. That such spores float about in the air in great numbers is shown by the commonness of molds.

Another common mold, Mucor mucedo, has a life history different in some respects from the above, and sufficiently remarkable to deserve notice. This mold is quite large and the hyphæ can readily be seen with the naked eye; it commonly grows upon the fresh excrement of horses. In Mucor the ends of the erect hyphæ enlarge into single spherical box-like bodies within which the spores are contained. These boxes, or sporangia, when the spores are getting ripe, become covered with a thin coating of oxalate of lime, and at the same time the hyphæ lengthen out a great deal, and bend toward the light. Thus, after a while the sporangia strike against the surface from which the mold is growing, and its brittle covering bursts and allows the spores to escape.

Sometimes Mucor reproduces itself in a way still more remarkable. A couple of hyphæ come together at their tips swelling out as they approach each other. When they have come in contact, partitions form, cutting off the ends of each. The two ends then unite, forming a spherical body, and in it spores soon make their appearance. The body after a time becomes detached from the hyphæ and falls. After lying for six or seven weeks, the covering bursts through and the spores are diffused.

These two methods of generation occur alternately, and afford an example of the process called alternation of generations, and known of both animals and plants.—Cor. Country Gentleman.

VISIT TO MINES OF UNKNOWN PERIOD IN THE SERRO DE LAS CANAS.

Last Saturday, at 6 o'clock in the morning in company of Don Jesus Maria Chavez, the mining representative of this paper, behind a span of fast horses, took his departure for the old workings which are situated on the east side of the Rio Grande. At about 10 o'clock the base of the 500-foot and almost inaccessible cliff, upon the summit of which the old mines are situated, was reached. To ascend was by no means an easy task. However, after a half-hour's struggle the old shafts were in view. They were discovered in 1880 by Mr. Chaves, who while perambulating over this elevation, found his cane entering the soil in an unaccountable manner as he was leaning upon it. Upon examination he discovered that it had entered between two large rocks. Upon closer investigation he found that these large slabs covered the entrance to an opening beneath a dump in the vicinity, leading him to believe that an old abandoned mine lay beneath him. With some assistance he rolled away the obstacles, and upon exploring the shaft he found it to be about 70 feet deep, with a drift running to the east about 100 feet. As the roof has fallen in, numerous floors and many of the large chambers are filled with debris. It was found impossible to go further; but no doubt exists that these underground workings will be found to be of great magnitude when thoroughly explored. Just the reason why these shafts and drifts were excavated is hard to say, as no mineral is visible to the naked eye. Average rock of the crevice, however, is now being treated, and perhaps gold can be detected. Not the slightest vestige of European handicraft exists. A few fragments of indented and corrugated pottery upon the dump would indicate, however, that these properties were worked at a period anterior to the Spanish occupation of this territory, and are probably of that class of mines mentioned by Father Kino, the brave old priest and missionary, who in 1658 visited this land to evangelize the natives. In speaking of the miners of that period, he says: "They understand mining to some extent—not mere surface labor, but extracting the ore from the veins which they opened in solid rock, unearthing vast quantities of gold and silver, which they seemed

to value only as it contributed to their comfort when made into articles of use or ornament." Not far from one of the shafts, a beer bottle containing a location by Daniel Lemons and Robert Howard was found, dated February 18, 1882. The formation in the vicinity consists of strata of lime, underneath which lies thin but numerous strata of red and grey sandstone. At the base of the eminence large deposits of sulphate of lime were found. The dump of the old workings afforded sulphate of lime, calcite and limestone, but no quartz. The entire absence of primitive metamorphic rock and all signs of copper, iron or lead, were manifest. The determination of the component parts of the specimens selected will be awaited with no small interest.—Socorro Bullion.

ANTHROPOLOGY.

The earliest travelers among the Indians mention mounds with buildings on the top of them covered with earth. In the mounds which I have examined, wherever burnt clay has been found more or less ashes occur underneath, and the impress of grass, sticks, cane or poles plainly reveals itself in the burnt clay. These vegetable substances were needed to support the earthen roof of the dwelling.

The dwellings of some modern Indians are built of poles, sticks and grass, covered thickly with mud. Upon the death of any of the inmates the house is burned down, and the framework consuming partly bakes the clay and leaves its impress therein. The Pimos and Maricopas of the Gila river, with all of the Indians of the Colorado river, build winter and summer dwellings. The former are hemispherical and mud-covered, the latter is an open mud-covered shed. When these are burned down at death, the clay is baked and appears like that dug from many mounds.

In many of the modern houses the earth is dug out in the center for a foot or more; this points to the reason for the pits found in the middle of mounds. Charred posts are found in mounds, the same phenomenon presents itself whenever a summer shed is consumed.

In examining the celebrated ruins of adobe and stone houses in Arizona, it is found that they were destroyed by fire, burnt clay with impressions of sticks and poles being found in them.

The examination of some mounds demonstrates the existence of buildings without clay covering. Now I have lately visited several Indian tribes who live in the hot season under sheds covered with thatch, with merely earth enough above to keep the twigs from blowing away. Now the burning down of such a shelter would leave only ashes and charcoal.

Again, both houses are on the outside the receptacle of everything which the Indians wish to keep out of harm's way, baskets, pottery, wattled granaries for corn, mezquit, etc. Now in some mounds I have found the pottery and other relics so curiously located as to leave little doubt in my mind of the burning of such a structure as I have just described.

The modern hut builder does not cover his consumed dwelling with a mound because the new arts taught by the white man and his new environment have taken away all necessity. Furthermore, the argument that the superior arts of the former Indians were associated with better houses for the artists is false. The finest works of modern art are produced in places no more elegant than the Pimo's summer shed.—Edward Palmer, in Am. Nat.

THE DAVENPORT ELEPHANT PIPES.

Mr. Charles E. Putnam, of Davenport, Iowa, has published a pamphlet of thirty-eight pages as a vindication of the authenticity of the elephant pipes and inscribed tablets in the museum of the Davenport Academy of Natural Sciences, from the accusations of the Bureau of Ethnology of the Smithsonian Institution. Those who have known the history of Davenport Academy, its struggles and triumphs for the love of pure science, and the extreme caution of its leading members, regretted that anything

should appear in a Goverment publication reflecting upon their veracity or honesty. Tablets are common enough, being made of slate and other material and worn to-day by the present Indians of British Columbia and Alaska. So long as they do not contain outlandish and unclassifiable inscriptions there is nothing mysterious about them. On the contrary, the elephant pipes are mysterious. When I try to put the cast which we possess at the museum with something else, there is nothing to put with it. Professor Henry once said to one of his assistants who discovered an unclassifiable specimen: "That seems to stand out so unsociably that we must call it an 'outstanding phenomenon,' and wait patiently until something else turns up to go with it." The last word that should fall from the lips of a brother naturalist is "fraud."

On the other hand, barring this indiscretion, Henshaw is just what Major Powell says about him. He is a very careful and skillful naturalist. We should hail with delight the accession of all such men to the ranks of archæology because they bring light from every side to bear upon our mysteries. It should not make a particle of difference to any of us whether a pipe is the figure of a crow or of a toucan, so long as we know just what it represents. We may rest assured that for a long time every mystery solved will be accompanied by two quite as inexplicable.

But, really, too much account is being made of the matter. Squier and Davis are not overthrown. Their manatee, toucan and paraquet may be shot down by the ornithologist, but these practical gentlemen did not care a fig about such creatures. They made the greatest archæological survey and collections ever attempted in America, and their volume will indeed be a "monument" to their memory and to the glory of its authors for all time.

The Davenport Academy is not annihilated. Even if our theory should turn out true and the elephant pipe should prove a tapir pipe, and we should learn that tapirs once lived in the Mississippi valley, this grand association would survive.—O. T. Mason in Am. Nat.

THE SILVER QUESTION.

The following, from the Engineering and Mining Journal, states briefly the probable effect of the recent action of the Monetary Convention between the Latin Powers on the value of silver:

"France, Greece, Italy, and Switzerland have renewed the monetary convention for five years; silver coins redeemable in gold, no additional silver coinage permitted; convention open to Belgium."

This is the important announcement that comes to us by cable, and which is supplemented by a later dispatch, which says:

"The Monetary Convention between the Latin powers, providing for the suspension of the coinage of silver, permits each power to resume, provided the silver circulating in the other states is redeemed in gold by the resuming state."

In other words, the Latin Union has discarded bi-metalism and has agreed to redeem its present silver coinage in gold. Silver coinage will also be suspended, at least until the country has drawn into circulation the silver already coined. No more silver is to be coined for the present, and that already coined becomes, under this convention, simply a subsidiary coinage redeemable in gold. Belgium, which has been coining for many other countries, declines to redeem this coinage in gold, and consequently does not enter the Union. This action, in all probability, will lead to the adoption in this country of a policy similar to that of the Latin Union, for the redemption of silver in gold. It would be the purest folly for this country to continue coining silver beyond our needs, or of endeavoring alone to establish an arbitrary ratio between silver and gold.

This is the heaviest blow that the advocates of bi-metalism have received; but, no doubt, the step is necessary even in the interest of bi-metalism; for there is no prospect of England and Germany joining in the adoption of a standard ratio so long as

some of the countries continue to buy and coin their silver, leaving them the gold. England, through India, has perhaps a greater interest than any other country in maintaining the value of silver, and it may be that the depreciation in silver that will probably follow this action of the Latin Union may lead to some united action looking to the establishment of a standard ratio between gold and silver. That such action will be taken is, certainly, not immediately probable; and for some time to come, the value of silver will be more than ever dependent on the demand for commercial uses outside of coinage requirements.

THE PHILOSOPHY OF VACCINATION.

Professor Tyndall explains the philosophy of vaccination as follows: "When a tree or a bundle of wheat or barley straw is burned, a certain amount of mineral matter remains in the ashes,—extremely small in comparison with the bulk of the tree or of the straw, but absolutely essential to its growth. In a soil lacking, or exhausted of, the necessary constituents, the tree cannot live, the crop cannot grow. Now, contagia are living things, which demand certain elements of life, just as inexorably as trees or wheat or barley; and it is not difficult to see that a crop of a given parasite may so far use up a constituent existing in small quantities in the body, but essential in the growth of the parasite, as to render the body unfit for the production of a second crop. The soil is exhausted; and, until the lost constituent is restored, the body is protected from any further attack from the same disorder. Such an explanation of non-recurrent diseases naturally presents itself to a thorough believer in the germ theory; and such was the solution which, in reply to a question, I ventured to offer nearly fifteen years ago to an eminent physician. To exhaust a soil, however, a parasite less vigorous and destructive than the really virulent one may suffice; and if, after having, by means of a feebler organism, exhausted the soil without fatal result, the most highly virulent parasite be introduced into the system, it will prove powerless. This, in the language of the germ theory, is the whole secret of vaccination."

THE PYROPHORE.

At a recent meeting of the Academy of Sciences, at Paris, a plate half filled with water, in which were half a dozen insects about an inch in length, which shone like diamonds, although the room was filled with sunshine, was passed around among the members. These insects had been brought from Mexico, where they are to be found in the forests. Their scientific name is the pyrophore; and, as none had ever been seen before in Europe, they created quite a sensation. The light resembles that of a glow worm or a fire-fly, although as much more brilliant and intense as electric lamp surpasses a wax taper in its power of illumination. When the light begins to fade, it can be made as brilliant as before by shaking the insect, or dipping it in water. It is said the Indians of Mexico use them for a light at night, as a few will suffice to illuminate an entire room. When they are walking at night, they put one on each foot, so that they can be sure of their way, and also that they do not step upon any venomous snake or reptile with which the tropical forests abound. The Mexican ladies buy them from the Indians, and enclose them in a transparent bag, which they wear in their hair or at the neck. The effect is very beautiful, especially when several are worn; and, as the Indians sell them for a few cents a dozen, they are within the reach of every fair one. They are fed on sugar-cane, and, if well taken care of, will live a long time. One placed upon a page will enable it to be read with ease in the darkest night.

MONSTER SEA-TURTLE FOUND IN KANSAS.

The discoverer of a gigantic extinct sea-turtle found near Fort Wallace, in Western Kansas, first observed the large bony shields projecting from a bluff near Butte Creek.

They were carefully taken out and brought to Philadelphia, where the restoration was made. The fore-flippers alone were nearly five feet long, while its expanse from the tip of one extended flipper to another was about seventeen feet. The question may arise, how did this sea-turtle become buried in a bluff in the State of Kansas? A natural supposition would be that Kansas is the bed of a former ocean, and so it is. Ages ago, in what is called by geologists the Cretaceous Period, that part of the world was the bed of a great sea, in which the great turtle swam, together with other monsters of curious shape and appearance. Gradually the crust of the earth was raised, the water fell back, or became inclosed, and left the inhabitants of the Cretaceous Sea high and dry, to be covered by the earth and preserved for us to study ages afterward.

The shores of this ancient ocean are easily found and followed by geologists. Its extent has been traced on our Western plains by the bleaching and disintegrating remains that have been found, upon and beneath the surface.—Charles Frederick Holder, in St. Nicholas.

DIFFUSION PROCESS OF EXTRACTING BEET SUGAR.

At a late meeting of the Scientific Club at the Kansas Agricultural College Prof. Cowgill presented a paper on sugar-production, in which he sketched, briefly, the history of surgar-production and its various methods of manufacture. The most common sources of sugar are the tropical cane of the semi-tropical regions of North America, the sugar beet of France and adjacent countries, and the sorghum cane, which is an Asiatic plant, and was introduced from France into this country about thirty-two years ago, at which time it was hailed by abolitionists as a relief from the consumption of sugar produced by the slave labor. This produced a disappointment. It has been proved in France that the quantity of sugar found in the beet depends greatly upon the manner of cultivation; this is also true of sorghum. In the process of manufacture the following distinct processes are noted: extraction of the juices, cleansing of impurities, condensation of evaporation, crystallization, separation of crystals from syrup and refining. In the extraction of the juice by means of crushers, it is found that only about forty-five per cent. of the eighty-eight to ninety per cent. of juice in the weight of the cane is extracted. Or, in other words, only about one half of the juice is extracted. Besides this, the crushers break down the cell-walls in the cane and carry their substance into the juice, from which it cannot be removed. By the "diffusion" process, these objections are sought to be overcome by the cutting of the cane diagonally into chips of about one sixteenth to one eighth of an inch in thickness, and placing them in a tank which is divided into two compartments by a membrane, through which an osmose action can take place. The chips in one compartment are covered with water, and water placed on the other side of the membrane; and when, by diffusion, the liquids in both compartments attain the same consistency, a part of the juice has been extracted from the chips and held in solution on the water side of the membrane. This is drawn off and applied to fresh chips, and the process repeated until each measure of water has passed through six measures of chips, thus insuring about double the amount of juice extracted, and at a less cost than by means of the crusher.

A SUGGESTION THAT MAY PROVE OF VALUE.

Some one, reasoning on the hypothesis that organic life is only able to resist its destruction by the ordinary law of nature through the constant change of bulk and form of its body, has advanced a suggestion which may prove fruitful in these days of vivisection. When it is desirable to prolong the life of a plant, some parts are cut off from it or another body fastened to it, or vice versa; and of this sort of treatment for the promotion of longevity in the veg-

etable kingdom a most notable and successful instance is incidently cited—the rose bush, now nearly a thousand years old, which is trained on the wall of a church in Hildesheim. Further—accepting as true the proposition that in the animal kingdom those creatures which by some means are able to change the bulk or form of their bodies live longer than those that cannot do so—our author ventures the belief that we may lengthen human life by removing morbid matter at certain intervals, or by altering the form of the body !

A HUGE BRIDGE.

The project of a tunnel under the Straits of Messina, to connect Sicily with Italy, is an enterprise which has long received the attention of engineers and been recommended by scientific experts. Recently, however, a Piedmontese company has come forward with a counter project for a bridge, an enterprise which, it is remarked, will, if ever carried out, constitute as remarkable a work of the kind as there is in the world. According to the published statement, the width of the strait at its narrowest point is about two miles, but, owing to the great depth of the water—more than 500 feet—on this line, the projectors propose to locate the bridge where it would have a length of about two miles and a half. The plan of this gigantic structure involves four piers, connected by spans of five-eighths of a mile in length, the two shore arches having half the span of the three central ones.—Electrical Review.

THE KINETIC THEORY OF GASES.

The modern kinetic theory of gases, says Prof. Tait, in offeriug a suggestion as to the source of atmospheric electricity, shows that the particles of water vapor are so small that there are somewhere about three hundred millions of millions (a truly vast number) of them in a single cubic inch of saturated steam at ordinary atmospheric pressure. This corresponds to 1-1600 or so of a cubic inch of water, i. e., to about an average raindrop. But if each of the vapor particles had been by any cause electrified to one and the same potential, and all could be made to unite, the potential of the raindrop formed from them would be fifty million times greater. Thus it appears that if there be any cause which would give each particle of vapor an electric potential, even if that potential were smaller than any that can be indicated by most delicate electrometers, the aggregation of these particles into raindrops would easily explain the most formidable thunder cloud.

GETTING THE TASTE OF MUTTON.

A queer story comes from New Zealand. The owls in that island used to be harmless as doves; indeed, they were once "mousing owls," and, therefore, useful. But one night a settler left a sheepskin nailed to his roof, and an owl came along and tasted of the fat mutton left thereon. That owl became a sheep killer, alighting on a sheep's back three nights later. Still more strange, all the other owls began to like mutton, and now the New Zealand bird of that species slays thousands upon thousands of sheep, their appetites growing by what they feed on, and their numbers increasing in proportion to their prosperity. They alight on the backs of the sheep and tear the poor beasts with their beak, going at once down through the carcass to the kidney fat, which to the owl's tongue is the daintiest of morsels.—N. Y. Dispatch.

COINS AS DISEASE DISSEMINATORS.

That the small coins of all nations may be a most potent factor in disseminating disease is a discovery due to the researches of Dr. Reinch. Taking the specimens of coin which had been long in circulation he scraped off the thin organic incrustations, which he then divided into small pieces and dissolved them in distilled water. Microscopic inspection of the solution disclosed abundance of bacteria and vegetable fungi. After this there is ample reason for caution in handling money made of metal; of the

danger of filthy paper currency the public has long been aware. Application to coins of a boiling weak solution of caustic potash will, however, free them of their organic impurities. Withdrawal from the circulation of old, dirty dollar bills and replacing them by new ones is perhaps the best way to prevent paper money acting incidently a not considerable role in the mechanism of epidemics, as well as of mercantile exchange directly.

RED AND PURPLE RIBBONS SUPPRESSED.

In consequence of a letter written by Examiner Antisell, of the Patent Office, the secretary of the treasury has ordered the use of red and purple ribbons in the government type writers to be discontinued in preparing papers intended for permanent record.

In reply to queries of the acting secretary of the United States treasury, the examiner says: There are ten different ribbons used, five being copying ribbons, and five record ribbons. The word "permanent" which appears in the inquiries presented, should be understood as referring to power of resisting obliteration by the action of light, of washing, of treatment with acids and alkalies, as ordinarily practiced by those operating to remove the ink. The color of the ink may be changed by such treatment (as from blue to black, black to green, and other similar changes of shades), but, whether change of color be produced or not, the ink is not effaced; it is legible, the letters are not obliterated, and therefore such ink may be said to be permanent. This is eminently true of black record ribbons. Another ink is furnished, called the black indelible copying ink, which has also the above-mentioned properties of permanence.

The ribbons of other color than the foregoing are . . . found to be fugitive—red and purple particularly so. They, for this reason, should not be used for recording permanent records. These inks cannot be styled permanent. It may be stated here that the same ink has different results as it is applied on paper by the ordinary writing pen and as applied to similar paper by the type writer; in the latter instance, from its soaking more deeply by the impact of the machine, and being forced below the surface of the paper, it is more difficult to be removed or reached by chemical agents applied; therefore, an advantage accrues in the use of the type writer over the pen. "Are copies made on the type writer by the use of carbon paper permanent in their nature? may be answered as follows: If these carbon paper copies do not require to be frequently referred to, they may be said to be permanent in their nature. Owing to light pressure upon the paper, the ink is not deeply embedded, and may be easily removed by friction. This appears to be an objection to the use of carbon paper. In all cases where permanence is desired, the paper should be as thin as may be consistent with its cohesive strength, and bearing as little thickening material or size as possible.

GOLD UNDER PHILADELPHIA.

It has long been well understood that gold is the most universally distributed of metals, being found in all parts of the world, but most readers will probably be surprised at a statement recently made by Prof. A. E. Foote, of this city, to the effect that there is more gold in the clay under the city of Philadelphia than would equal the entire valuation of the city. In 1812, men made sixty cents a day in washing the sands near Chester, on the Delaware River, where William Penn first landed, and quite recently several dollars' worth of gold in grains were taken from a well one hundred and fifty feet deep within twenty miles of Philadelphia.—Wood and Steel.

HOW OLD SOL USED TO SHINE.

In 1303 and 1304 the Rhine, Loire and Seine ran dry. The heat in several French provinces during the summer of 1705 was equal to that of a glass furnace. Meat could be cooked by merely exposing it to the sun.

Not a soul dare venture out between noon and 4 p. m.

In 1718 many shops had to close; the theaters never opened their doors for three months. Not a drop of water fell during six months.

In 1773 the thermometer rose to 118 degrees.

In 1778 the heat at Bologna was so great that a great number of people were stifled. There was not sufficient air for the breath, and people had to take refuge under the ground.

In July, 1793, the heat again became intolerable. Vegetables were burned up and fruit dried upon the trees. The furniture and wood-work in dwelling houses cracked and split up; meat went bad in an hour.

ANCIENT RIVERS.

The ancient gravel channels of California were formed, it is believed, during the Pliocene period, and extend from Mariposa county in the south to Siskiyou county in the north, having an aggregate length of about 320 miles. The auriferous area has been estimated to be 200 square miles. These channels are from 200 to 400 feet wide on the bottom, and sometimes as much as 2,000 feet wide on the surface. They are filled with gravel from depths of 20 to 400 feet. The deposit at the bottom consists of boulders, cobbles, gravel and sand firmly cemented together. This bottom deposit is commonly known as the "blue lead" from its color, and varies in thickness from 20 to 120 feet. Above the "blue gravel" is found the "top gravel," consisting of sand and occasional boulders, with sometimes layers of pipe clay. Near the surface is found red soil, varying from a few feet wide to 20 feet in thickness. Gold is distributed very uniformly through the entire mass of gravel, being most abundant near the bed-rock. These ancient channels are sinuous in their course and have many branches and tributaries. Their grades vary from 20 to 300 feet per mile—sometimes confined within narrow banks and again assuming lacustrine proportions. They undoubtedly carried more water than do the present rivers of California. The fact of the material being coarser and larger at the bottom is due to the great velocity of the rivers where confined to narrow channels. As the filling increased the transporting power of the streams became less from the diminished depth of the water, and hence the latter deposit was of firm material.

The principal gravel mines of California are situated in the counties of Yuba, Sierra, Placer and Nevada, in the region drained by the Feather, Yuba and Bear rivers. It has been estimated from careful canvass of this industry, that there are on the drainage system of these rivers 300 mines or tracts of mining lands which have been worked within the past three years, though not, perhaps, simultaneously, by the method distinctively known as "hydraulicking," besides numerous "drifts," "rivers" and placer mines, which are dependent upon water washing. The magnitude of these mines, whether hydraulic or drift, depends on the width and length of the channel.—W. A. Skidmore, in Mining Review.

THE TORONTO ELECTRIC RAILWAY.

The electric railway now being operated by the Toronto industrial Exposition is a perfect success. It is something entirely new, and differs from the one run here last year. It is not a toy or an experiment, but a practical railway, carrying the visitors to and from the fair grounds, making connections with the horse cars. When it is considered that the maximum of power used was only thirty-horse power, and that the number of passengers carried on Saturday last was nearly six thousand, and yesterday ten thousand, it is truly wonderful. The motor, which is one of the latest improvements of Mr. Van Depoele, is placed upon one of the cars and is connected to the axles. It is controlled, and made to run fast or slow as desired. The electric current is conveyed to the motor through an overhead one-fourth inch copper wire; it passes into a small copper wheel which is on top of the car, and presses against the under

side of the wire, thence through the motor to the car wheels, then through the track back to the generator.

The length of track is nearly one mile, with curves of 250 feet radius and grades three-fourths of an inch to the foot. The run over the track takes 2½ minutes. The company has only three cars besides the motor cars, hence it was necessary to do lively work on Saturday last and yesterday. The cars were run for fifteen hours continuously. The average time for round trips, including loading and unloading passengers, was ten and one-half minutes. It is doubtful if this has ever been beaten.

This motor and electric railway system is the invention of Charles J. Van Depoele, electrician of the Van Depoele Electric Manufacturing Company, of Chicago. Van Depoele claims that he can, with his system, run forty or more trains at a time on the elevated railways of New York, or run trains fifty or more miles with great saving over steam locomotives.

A PEDAGOGUE IN KANSAS.

The first visit to the wonderful state of Kansas is apt to leave the mind in a condition as disheveled as a maiden with a mighty "head of hair" in one of the brisk, breezy days of that many-sided state. Although one of the youngest states in the world, Kansas rivals old England in the wondrous beauty of her fields and the refined and subdued lines of her exquisite "rolling prairies." Within a space of ten days, in June, we encountered weather enough to suit the most fastidious and versatile new-comer. Scores of towns, before only names on a railroad map, were found busy centers of industry, each with a mighty hope for the future. There are too many good things in Kansas for one number of "Drift." But the glory of all is the common school which new Kansas wears on her bosom, like a splendid maiden arrayed in her beautiful garments, wearing a boquet of "flowers of all hue, and without thorn the rose." The public schools of its cities are in a state of hopeful rivalry with each other. The county superintendents, whom we met in council, are a body of earnest, often able men, with twelve lady superintendents for their "aid and comfort." State Superintendent of Instruction Lawhead, is a good man in a large place. The State Normal School at Emporia, is crowded with pupils and working towards the best results. The agricultural college at Manhattan, under the presidency of one of the Fairchild brothers, is unsurpassed for beauty of situation and skillful adaptation to the public need. Kansas desires the presence of the National Convention, next year, at Topeka, and very strong reasons must be given for rejecting her invitation.—Journal of Education.

COMPRESSED AIR STREET CARS.

The line of the London Street Tramways Company from Holloway to King's Cross, is about to be worked exclusively by compressed air machinery instead of horses, as hitherto.

Underneath the car body is a series of cylindrical reservoirs, which may be charged with enough compressed air to propel it a distance of ten or twelve miles. The car is four wheeled, one pair of these wheels alone being used for driving; and, to save the expense and inconvenience of turn-tables, the car may be driven from both ends. To the driving wheels are attached a pair of high and low pressure ordinary working cylinders, each of 8 inches stroke. Means are provided by which the high pressure air can be used in the low pressure cylinder, if necessary, for starting. The air in passing from the reservoirs to the cylinders bubbles through boiling water and steam of sixty pounds pressure on the square inch, contained in a vessel called the "hot pot," of which there is one at each end. This vessel is charged at the pumping station during the time occupied in charging the car with compressed air. The advantages claimed in thus using the air, are that the heat which the air takes up in passing through the hot water not only causes the air to expand, but prevents the formation of snow in the cylinders at the exhaust. The mois-

ture also picked up by the air in its passage through the hot water acts as a lubricant for the side valves and pistons.—Railway and Tramway Express.

SCIENCE AND THE GOVERNMENT.

Frank Wigglesworth Clarke notes the growing dependence upon scientific methods as a noteworthy feature of modern civilization, and finds in our national administration an amazing development in certain lines of scientific industry. Every executive department either has scientific experts connected with it, or employs such experts at times to conduct its investigations. There is a considerable demand for science in the defensive branches of the public service, such as the army and navy. The weather service uses the electric light to great advantage. The Department of Agriculture applies scientific research to the assistance of great industries. The Mint and Assay Offices has much to do with chemistry. The geological surveys develop more fully the principles of geologic science, and from an economic point of view investigate our mineral resources. The Patent Office reveals the fact that the Government has become the arbiter in doubtful questions of scientific priority. Scientific work is also frequently carried on at Government expense, which aims at the discovery of truth for its own sake, like the expeditions to observe the transit of Venus and the solar eclipse, as well as service rendered by the Beareau of Ethnology.

A LITTER OF BABIES.

A correspondent of the Cincinnati Enquirer relates the following:

"A remarkable story comes from Henry county, just west of this city, (Toledo) which, if it were not thoroughly substantiated, would be almost incredible. It is to the effect that several days ago the wife of Wilhelm Freund, a German farmer, living about half a mile from Holgate, gave birth to five children, all boys, and that all the infants are well formed and alive. When the Enquirer correspondent investigated this stupendous increase in the census he found that the event is but one of a series that have happened in this interesting family. Mrs. Freund is 36 years of age, and during her nineteen years of married life has given birth to twenty-one children, eighteen of whom are now alive. The other three lived to various ages over a year. Dr. Townsend, of Holgate, has been in attendance at most of these events, and Dr. Harrison, of Napoleon, is also conversant with the facts and has assisted on some occasions. The mother is described as a comely German woman, raw-boned and spare, and the father short and solid, but not portly. This happy couple live on a small farm, which the husband tills with the assistance of his numerous progeny. Some of the children, it is said, were born in the hay-field where the mother was at work."

INSECTS AS FOOD.

Locusts, so much dreaded by the farmers of all the civilized countries, are welcome in Arabia, and China, whose inhabitants look upon fried grasshoppers as a most favored dish. Livingston, the famous traveler, saw some tribes in Africa, who preferred buns of meal made from dried insects like our mosquito. Dr. Sneider, of Denmark, describes two other insects used as food. The mountain rivers and brooks of Chili abound in minute water beetles (Elmis Condimentarius) which are fished out by the natives in large quantities. After being dried, these beetles are used as a condiment known under the name of shishee. Shishee sauce is much valued in Chili and Peru. In the salt lakes of Nevada there are found millions upon millions of the larvæ of a fly known as Ephydra Californica. In July, when the larvæ are fully developed, the Indians collect them on the shores, dry them in the sun, and then squeeze them with their fingers. Thus they get a kind of grain which looks like rice of yellowish hue, which is ground into meal. From this meal the redskins prepare an excellent broth. In the lakes of Egypt and

Sahara, also, there are larvæ which are used by the natives as food.

NEW APPLICATION OF IRON.

According to the San Francisco Chronicle, an inventor in Stockton, California, has discovered a new process of preparing iron, which is said to make a metal tougher and more elastic than steel. The material is to be known as cast wrought iron. It is a composition of which 70 per cent is cast iron, most of the carbon being taken out. Its manufacture costs from six cents to seven cents a pound, and the iron can be made in any ordinary iron foundry. It is said to be the strongest ever made, 100 pounds of it giving three times the strength of 150 pounds of cast steel. It is claimed that besides being tougher, stronger and more elastic than cast steel, the new metal can be easily forged without the slightest danger of chipping off. Under the lathe the metal gives a shaving similar to that of wrought iron and presents a smooth, close-grained surface. The peculiar qualities of the new substance, it is asserted, make it superior for machinery, as it can be made lighter and yet possess the required strength.

TORNADO PREDICTIONS.

Mr. William A. Eddy, the tornado expert of the Signal Service Bureau, calls attention to the fact that the study of the phenomena of tornadoes has advanced so far that predictions of the appearance of these terrible destructive agencies can be made with a considerable degree of accuracy. Of thirty-eight predictions that tornadoes would occur in April and June of last year, eighteen were verified; of nineteen predictions in June and July of this year, fifteen were generally verified, and where regular tornadoes failed to arrive, violent wind and hail storms partially fulfilled the prophecy. Mr. Eddy thinks that a system of tornado signals should be established at every telegraph station in the tornado states. If the Government will do this much, at least some of the terrible loss of life and property due to tornadoes, can be averted. The facts presented by Mr. Eddy fully warrant the small appropriation by Congress which will be necessary to establish such a system of signals.

A NEW GOLD-LIKE ALLOY.

The Chemical News, of London, calls attention to the fact that a new alloy, resembling gold in appearance, weight, and in withstanding the jeweler's test of strong acids, is extensively manufactured in England, chiefly, Mr. Lowe naively states, for the purpose of defrauding pawnbrokers, to whom articles of jewelry made of it are frequently offered in pledge. Mr. Lowe examined a bracelet that had been sold as gold to a gentleman in Liverpool. After scraping off the gilding, the article had the color of nine-carat gold. It was found on analysis to have the following composition:

Silver	2.48
Platinum	32.02
Copper (by difference)	65.50
Total	100.00

He adds that strong boiling in nitric acid, even when the article was left in it for some time, had apparently no effect upon the alloy. The alloy is called "mystery gold."

WEIGHT OF COIN.

The standard gold dollar of the United States contains gold of nine-tenths fineness 25.8 grains, and the standard silver dollar contains silver of nine-tenths finenesss 412.5 grains. One million standard gold dollars, consequently, weigh 25,800,000 grains, or 53,750 ounces troy, or 4,479.16 pounds troy of 5,760 grains each, or 3,685.71 pounds avoirdupois of 7,000 grains each, or 1,863-1,000 "short" tons of 2,000 avoirdupois each, or 1,645-1,000 "long" tons of 2,200 pounds avoirdupois each. One million standard silver dollars weigh 412,500,000 grains, or 859,375 ounces troy, or 71,614.58 pounds troy, or 58,628.57 pounds avoirdupois, or 29,464-1,000 "short" tons of 2,000 pounds avoirdupois each, or 26,307-1,000 "long" tons of 2,240 pounds avoirdupois each. In round numbers the weight

of $1,000,000 in standard gold coin is 1⅔ tons; standard silver coin 25 tons; minor coin, 5c. nickel, 100 tons.

SPONTANEOUS COMBUSTION FROM COAL-DUST.

M. Fayol concludes that the absorption of atmospheric oxygen by coal-dust usually produces the rise in temperature to which spontaneous combustion is due. He finds that lignite is ignited at the low temperature of 800 degrees, anthracite at 575 degrees, and other varieties of coal, in powdered form, at intermediate temperatures.

TRANSPORTING NATURAL GAS.

Some one is proposing to liquefy natural gas and transport it as a liquid or solid. As natural gas is composed chiefly (95 per cent) of marsh-gas, which can be liquefied only at a very heavy pressure, the probability of explosions would make its carriage and storage in this form rather undesirable. The transportation of natural gas or of water-gas through large mains can be economically effected for any desirable distance without having recourse to so expensive and dangerous a plan as that referred to.

MISCELLANY.

A CYLINDRICAL JAIL.

In describing a new and particular jail just completed the Omaha Bee says: "The new jail just completed cost $30,000. Its peculiar feature is that the cells are arranged in the form of a great iron cylinder, which revolves about so that only one cell is at the opening at any one time. This cylinder is three stories high, there being ten cells on each floor. Its weight is 45 tons, and this ponderous weight is hung from above instead of turning on a track below. The strangest part of the arrangement is, that the great cylinder can be turned by a simple crank with little force, a man with his left hand moving it readily. When all is complete it is the intention to have a little water motor in the basement, and then by simply moving a lever the cylinder will be set to rotating. It is suggested that, when there are prisioners who it is feared may be trying to cut out, the cylinder can, by a motor, be easily kept moving slowly all night, so that the prisoners do not remain long enongh in one place to do any mischief, or even to crawl out if they had made a partial breāk. It seems that prisoners have little chance for escape from this new jail. A cage of iron bars completely surrounds the cylinder in which the cells are. The entrance on each floor is guarded by two doors. The officer standing outside does not have to unlock even the the first door, but can swing the cylinder around until the cell appears in which is the desired prisoner, and then by a simple movement the inner door is opened and the prisoner can step out of his cell. Then the officer can open the other door and let the man out, but the other prisoners are way beyond any possible reach of the officer, and it is impossible for them to make any break on him while he is taking a man out or putting another one in. He can handle any number of men in the same way, and they cannot get withim reach of him until he chooses to let them.

IMAGINATION AND DYING.

In reference to the influence of the imagination on the body, a doctor tells the following story in the Chicago Times: "A big hulking fellow about ten miles from the town I was practising in, got the idea that he was going to die at just 11 o'clock in the forenoon of a certain day. About 9 o'clock a messenger came for me, I hurried out. When I got there the crank had fifteen

minutes to live, according to his calculation. He did look like a man on the verge of eternity. His eyes were dim and sunken, his face had that peculiar pallor which heralds the near approach of death, and his breathing was very labored. The family were gathered around and weeping as they took a final leave. Something had to be done quick. There was a smart-looking woman there, and I called her aside. Pointing to the clock on the mantlepiece, which the patient was watching, I said: 'When I have his attention, turn that ahead.' Then I crowded into the family group, bustled them into the next room, sat down on the edge of the bed and began telling that fellow one of the most horrible murder stories you ever heard. I located it right in the town where he knew everybody, named the woman killed, went into blood-curdling details, and so completely interested the man that he forgot his eleven o'clock appointment. When I gave him a chance to look again it was twenty minutes to twelve, and he was actually mad for a time, claiming that he had been tricked. He finally got to laughing, and we all took dinner together. The next day he whipped two men at a barn-raising for twitting him about the programme of death that miscarried."

THE LAW OF FINDING.

The law of finding, says a writer, is this: The finder has a clear title against the world, except the owner. The proprietor of a coach, or a railroad car, or a ship, has no right to demand the property on a promise. Such proprietors may make regulations in regard to lost property which will bind their employes, but they cannot the public. The law of finding was declared by the king's bench 100 years ago, in a case in which the facts were these: A person found a wallet containing a sum of money on a shop floor. He handed the wallet and contents to the shopkeeper. The latter refused to deliver them upon the ground that they were found upon his premises. The former sued the shopkeeper, and it was held as above set forth, that against all the world but the owner, the title of the finder has been held to stand in the place of the owner, so that he was permitted to prevail in an action against a person who found an article which the plaintiff had originally found, but subsequently lost. The police have no special rights in regard to articles lost, unless those right are conferred by statute. Receivers of articles stolen are trustees for the owner or finder. They have no power in the absence of special statute to keep an article against the finder, any more than a finder has to retain an article against the owner.

COMMERCIAL RELICS OF ANCIENT ROME.

An interesting discovery illustrating the commerce and the luxury of ancient Rome has been made close to Monte Testaccio and the English cemetery. The whole of that district to the west of the Aventine outside of the Porta Tregemina was occu pied by granaries and warehouses for the storage of imports of all kinds. Between the northern side of Monte Testaccio and the Tiber there still exist colossal remains of the great emporium built by Marcus Emilius Lepidus and Emilius Paulus nearly 200 years before the Christian Era. In the year 1868 a considerable portion of the quays was discovered, together with some 600 blocks, many of them of large size, of rare, variegated marbles of all kinds, lying just where they were landed from the galleys which had brought them from Numidia, the Grecian Islands, and Asia Minor, fifteen centuries ago.

Now, in the course of the building operations in this locality, two warehouses have been discovered, one filled with elephants' tusks and the other with lentils. It is curious to find such product stored side by side; but as bags of lentils were sometimes shipped as ballast, they may have served that purpose. The discovery would have been a very valuable one if, unfortunately, the ivory had not been much decayed.

REMARKABLE DREAMS.

Among the most remarkable dreams on record the following will always have their place:

Breakfasting with some ladies on Wednesday, November 25, 1779, at his house on Hill street, London, Thomas, Lord Littleton, spoke of a very curious dream he had dreamed in the night. In this dream a bird flew into the room where he was and while he looked at it, it changed into a woman, who told him to prepare for another world, as in three days he would die. He was then well, and, as he laughingly said, he did not look like a man so near death. On the Saturday also, he felt perfectly well, and believed he should "bilk the ghost."

Some hours afterward he went with Mr. Fortesque and Captain Wolsely to Pitt Place, Epsom, ate for supper an egg, went cheerfully and talkatively to bed, hoped he should have good rolls for breakfast and suddenly expired, while Stucky, his servant, was assisting him to remove his under waistcoat. This story has been told in various ways. The above account is that given by Lord Westcote, Lord Lyttleton's uncle.

John Aubrey tells that a poor cloth-worker's wife, living in Gilford, named Abbott, dreamed that if she would eat a jack, her son, who was about to be born, would grow up and become a great man. Early the next morning she went to the river for water and caught in her pail a fine jack, which she cooked and ate—all or nearly all. The child was born, grew up, became a scholar in the town, and finally became Archbishop of Canterbury—of course through his mother eating the fish, or so thought John Aubrey, F. R. S.

Vouched for by tradition and history the strange dream of the Swaffham tinker has a fair claim to rank with the wonderful dreams to which this article is devoted. The story of it runs as follows:

About three hundred or more years ago, the above named ancient town in Norfolk, remarkable of old for its healthiness and beauty, had among its inhabitants an industrious, hard-working tinker named John Chapman, traditionally said to have been the beneficent builder of the north aisle of Swaffham Church. Certain it is that in the north aisle there are various devices of a peddler and his dog, and of a shop-keeper or Chapman, which seems like a rebus upon the traditional name, a species of conceit prevalent in ancient times. Certain also, it is, that in 1462 the name of one of the church wardens was Chapman, and that in each of the original windows of this aisle was a painting of the tinker, his wife and three children.

One night the tinker dreamed that if he went to London and stood on London bridge he would there meet some one who would make his fortune and put and end to all the weary wanderings over hill and dale in search of work. Deeply impressed by this dream he spoke of it in the morning to his wife, so seriously and with such an evident belief in it, that she both scolded and laughed at what she called his folly. Strangely enough, as the tinker thought, the dream which had haunted his mind all day was repeated on the next night; and the impression, thus deepened and strengthened, not unnaturally brought a third repetition of it on the night following, after which John was no longer withheld from going to London.

Despite the remonstrance of his friends, the entreaties of his wife, and the ridicule of his neighbors, the tinker set out to travel all the way afoot, a distance of not less than ninety miles. At the close of the third day he reached the end of his journey, slept at an inn, and early in the morning stationed himself on London Bridge, at a spot which he remembered was that pointed out to him in a dream. And there he remained all day, eyed curiously by the passers-by and suspiciously by the shopkeepers who lived on the bridge and by the keepers of its gates, which closed at a certain regular hour to guard the city fron evil characters, on which the Bankside and other parts of Southwork had a larger share than was good for its reputation. Nothing was, however, said to him that appeared to be in

any way connected with his dream.

The experiment was repeated on the second day with no other result than that of intensifying the curiosity and suspicion which he had provoked on the first day. But after he had passed the third day on the bridge, and the evening gloom, which warned him of the closing gates, was again upon him, one of the shopkeepers, who had eyed him wonderingly on each previous occasion, ventured to ask him what possible reason he could have for standing there every day and all day long. The tinker confessed that he had been induced to make a fool of himself by a very singular dream. The stranger laughed at him heartily. "If I had been as credulous as you are," said he, "I should be on just such another fool's errand; for three nights this week I dreamed the same dream, and in it I was told to go to a place called Swaffham, which I find is ninety odd miles away. I thought in my dream that under an apple tree in an orchard on the north side of the town I was told to dig, and that there I should discover a box full of money."

After some further questions and answers on either side they parted; and the tinker, saying nothing of the place he had come from, went away again hopeful and with restored cheerfulness and faith in his dream, set out early the next morning for home. One of the first things he did on reaching it was to visit the orchard indicated by the stranger's dream. He recognized it at once by certain peculiarities of the tree he had asked the London dreamer to describe, and digging under it, soon laid bare the top of an iron box. To unearth this and convey it to his house unobserved was his next task, and this accomplished, it was opened and found to be full of money. Imagine his triumph and delight! On the outside of the box were some words, which, being unable to read, he did not know the meaning of. Afraid to make his secret known or arouse the suspicion, which might lead to unpleasant circumstances, he hit upon a plan for finding out what the words said. This was to place the box at the door of the grammar school, so that its inscription might be read by the boys as they came out and while he stood by, as if by accident. The boys soon gathered round the box, and one scraping the dirt and rust from the inscription, read, doubtless amongst much laughter, the apparent meaningless lines:

> Where this casket stood
> Is another twice as good.

Hearing these significant words, John Chapman went away, hardly able to restrain his exultation and pleasure, and early next morning he was again digging in the deserted orchard, where his efforts were rewarded by the discovery of a second casket, twice as large as the first and equally well filled.

LINCOLNSHIRE DIALECT.

Our American customs of calling the prong of a fork a tyne is a Lincolnshire peculiarity, and came over with our forefathers. The more general word prong is indeed driving it out, but a tyne is understood in Lincolnshire alone. The older men here distinctly remember the pronunciation of nature and creature, natur and critter, just as they were pronounced in New England fifty years ago. Perhaps the most amusing of these local peculiarties is the old-fashioned Lincolnshire way of calling a cucumber a cowcumber, which the older readers of The Courant will promptly recall as common in their childhood. So, too, the quaint archaism which many of us so well remember of calling a cow a caow, and a pound a paound, remains in full force not only in Lincolnshire, but has extended throughout England, and may be called the accepted pronunciation of the diphthong ou. I hear it not only in the cathedral pulpits, but on the lips of the shop boys. It has survived in Philadelphia and perhaps elsewhere with us, but it has mainly been laughed out of New England.

But to me the most interesting connection between Lincolnshire and New England pronunciation is the little word "been." It has long been a wonder to me how and why that word should be pronounced not only in New England, but throughout the

United States, so differently from what it is in England, Scotland, Ireland, Canada, Australia, Nova Scotia, South Africa; it is made to rhyme with seen and between, whereas in our country it is made to rhyme with sin and din. It was all explained when I came to Lincolnshire and found that the old local usage there was to call it bin, and that it is not entirely driven out to this day. I have not been able to trace that other old-fashioned pronunciation of the same word, "ben;" I could not find it in Lincolnshire. But many words which the older people will remember as now mostly gone by, such as put with a short u, pretty pronounced puhty, and purty, heard pronounced heerd, I find well remembered in Lincoln and Boston.—Hartford Courant.

TURQUOISE.

The first historic record of turquoise mining in Persia, occurs about the tenth century, A. D., and for ages has been one of the most important sources of wealth in this country. The Persian name for the stone is Firvoz, and the mines now worked are the same as those worked 800 years ago. They are found in Kerman and Khorassan, though the former are now almost abandoned, the light green color and early fading making them of small value. These mines are of great depth, and access to them is hazardous. The Persians and the people of the United States prize the darkest stones, while in Europe those of a fine light blue, of medium intensity are preferred. The former are more rare, and retain their color longer. Although in general, size has much to do with the value of a turquoise, color is the final test that fixes the price. There is a turquoise now in the bazaars, no larger than a pea valued at $800. All the mines of Persia are farmed by officers connected with the Persian government. They pay a yearly rental to the shah of 18,000 tomans, or $30,000. There are no other mines known in modern times that have produced stones of noted value, or in any quantity, except the mines of New Mexico.

The New Mexico mines are two in number, and are located about eighteen miles southwest of Santa Fe, in the Cerrillos mining district, being known as the Chalchuitl and Castillian. The history of the former mine is very interesting, associated as it is with the earliest Spanish conquests, where avarice and cruelty resulted in bringing about great loss of life and many reverses to the Spaniards.

This mine was probably largely worked by the Aztecs more than 300 years ago, so that in 1540, when Coronado and his followers penetrated into this country and captured (after a severe siege) the present city of Santa Fe, then a populous Indian village, their cupidity was aroused and enslaving their poor captives for more than 100 years the gloomy recesses of the mine were thickly populated by the hapless race, lashed by the most cruel of taskmasters.

The veins of turquoise in this mine run horizontally instead of vertically, as in the Castillian, and it was so extensively undermined in getting out the precious material that on one inauspicious day in 1680 the whole top of the mountain settled down, crushing and burying about eighty Indian miners. This terrible calamity, coupled with the fact that an effort was soon made by the Spaniards to re-open the mine, thus violating one of the fundamental principles of the Aztec faith, never to molest graves of kindred, so incensed the Indians that they rose in rebellion and successfully expelled their former conquerors from the country. Santa Fe was captured, many of the Spaniards were massacred, and the balance compelled to flee for their lives, the Indians being complete masters of the situation for a period of sixteen years. So intense was their hatred of the Spaniards that San Miguel church was leveled to the ground and everything portable taken to the plaza and burned near where the soldiers' monument now stands. It is believed that many historical and official documents that were in the governor's palace at the time were thus lost, and that valuable mines and springs were filled up and destroyed out of revenge.

1886.

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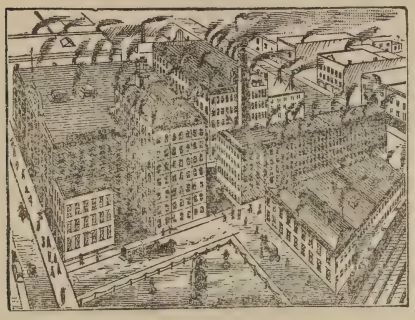
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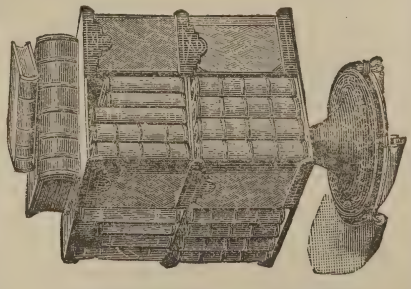
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TABLE OF CONTENTS.

PAGE.

PHILOSOPHY.
1. A Plea for the Occult.* Hon R. T. Van Horn 413

MINERALOGY.
1. Identification of Minerals 425

PROCEEDINGS OF SOCIETIES.
1. Social Science Convention of Kansas and Western Missouri 429
2. Art from a Practical Standpoint Mrs. S. M. Ford. 430
3. Seventeenth Annual Meeting of the Kansas Academy of Science 454
4. Address: Necessity of State Geological Survey. Dr. R. J. Brown . . . 454

ARCHÆOLOGY.
1. The Lost Atlantis. Mrs. H. M. Holden 435
2. Buried Cities 440

ASTRONOMY.
1. Sun and Planets for December.* 1884, Wm. Dawson 445

METEOROLOGY.
1. The Panama Canal, Influence of, Upon Climate.* M. O. Baldwin, M. D 446
2. The Atmospheric Haze of 1883 and 1884.* W. H. Pratt 447
3. Kansas Weather Service.* Prof. J.T Lovewell 451
4. Is the Rainfall of Kansas Increasing? Prof. F. H. Snow 456

ENGINEERING.
1. American and English City Rapid Transit 452

PAGE.

GEOLOGY.
1. The Gravels of Southern Kansas.* G. C. Broadhead 453

MEDICINE AND HYGIENE.
1. Cocaine as a Local Anæsthetic.* F. B. Tiffany, M. D. 462

BOOK NOTICES.*
1. Annual Report of the Smithsonian Institution for 1882 464
2. Publications of the Washburn Observatory, Vol. II. 464
3. First Principles of Natural Philosophy. Sheldon & Co 465
4. The Home Physician, G. P. Putnam's Sons 465
5. Bulletin of the Museum of the State University of Missouri 465
6. Public Relief and Private Charity. G. P. Putnam's Sons 466
7. A Young Girl's Wooing. Dodd, Meade & Co 467
8. The Religions of the Ancient World. J. Fitzgerald & Co. 467
9. Other Publications Received 468

SCIENTIFIC MISCELLANY.
1. Recently Patented Improvements.* J. C. Higdon, M. E 468
2. The Grasses of the Great Plains . . . 469
3. The State of Iowa One Hundred and Sixty Years Ago 470
4. The Laboratory that Jack Built. 472
5. Spouting Oil-Wells in Russia 475

EDITORIAL NOTES 473

ITEMS FROM PERIODICALS 475

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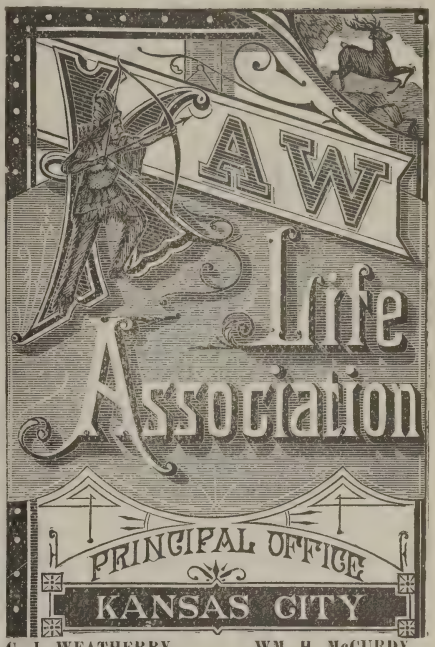
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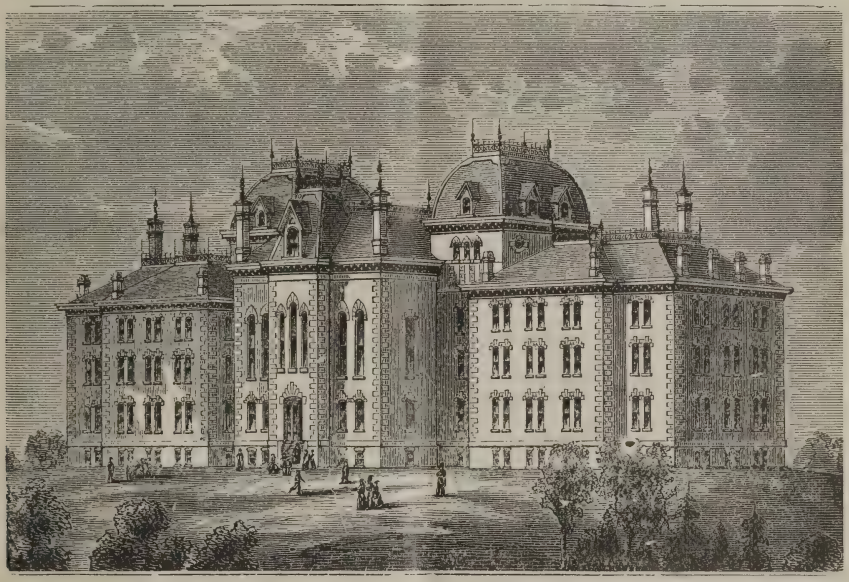
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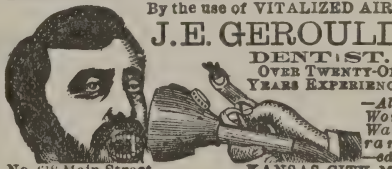
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VOL. VIII. DECEMBER, 1884. NO. 8.

PHILOSOPHY.

A PLEA FOR THE OCCULT.[1]

HON. R. T. VAN HORN.

Our culture is drifting to specialty—is becoming one-sided. Our science and philosophy are specialized. Science confines itself to merely physical things, ignoring ethics; while theology restricts its teaching to the future life of man. There is no unity, each following its own lines of thought. There can be no completeness by this method. It is unscientific because all we can know of physical phenomena is from the action of unseen force. Nor can we comprehend the unseen by passing the facts and laws of the physical world. Man can never reach true knowledge until he studies both by the light which this inseparable relation suggests. It is from this fact that the subject of this paper is chosen—the occult in nature.

And it is well before beginning a topic to know the value of words. Occult in its strict etymology means to hide—hidden. Its popular use, including the so-called supernatural or superstitious, is not the sense in which it will be employed in what follows. In the newer philosophy there is no such thing as the supernatural. The ancient philosophers used it in the sense of the principle of things—or the unseen in nature as distinguished from the manifest. But modern

1 Read November 15, 1884, before the Kansas City Academy of Sciences.

science has rejected this conception of Aristotle, and substituted force and molecular action in its stead.

In the history of knowledge, however, we find the occult to be but a relative term. What was so in a former age is known in this, and what was occult yesterday is manifest to-day. It is in this sense we propose to deal with the word and the idea. The world had the occult in astrology, alchemy, magic, and the lightning and thunder. To-day they are knowledge, under the names of astronomy, chemistry, magnetism and electricity. The occult is now only as to the nature of these things. And this is so only, as modern thought apprehends, because thinking is fettered by fundamental conceptions as to premises, that obtained when all these were occult. The modes of thought have not been revised with the facts. Or, in other words, the basic conception of nature has not changed with the observed facts of investigation. When we go back to the time when astronomy, chemistry, magnetism and electricity were hidden from man, or obscured, we can readily grasp the theories resulting. But when we come to interpret phenomena by the light of what is now revealed we find the old systems inadequate and irreconcilable. This fact, lying at the very bottom of the discussion, accounts for the confusion of what we call the science and ethics of the time.

We are gradually changing the old form, from the occult and manifest, to a definition more in harmony with our own idioms—the seen and the unseen. Metaphysicians tell us that things as we see them are not real, only apparent or relative; that this being so, we cannot really know anything. Or, that beyond what is material and tangible is unknowable. But this is again because of the old mistake as to fundamental conceptions—or a mistake as to what is real. Our senses are for objective uses—to guard and protect the body. How then can they be the sum of knowing, or the only vehicle of knowledge. They but convey forms of knowledge to the real knower. We now recognize that the unseen governs the seen in all things. We can never attain to true wisdom by searching for the secrets of nature through matter, or for the causes of things in the physical realm. Man ought to know that it is the unseen part of himself that rules the seen. Why, then, cannot knowledge accept this fact for all as well as for self? Science calls these things the "imponderable forces." Is there any force that is ponderable? Is not, then, the unseen the real? Without the presence of the unseen everything is dead. Why then beat over the old straw of matter which when the unseen is absent is nothing?

Monotheism has been but in part developed. It reached the plane of one God, took the form of a personality distinct and apart from all else, and has so remained for thousands of years. This personality, thus dwarfed, ruled the universe and managed it as will or caprice determined. But monotheism itself now feels the impulse of the newer thought, and is unfolding as a universal principle, the conception of which is to be interpreted from universal nature. Or, in other words, the one God pervades every atom of nature as one force, one prin-

ciple, one potency—the phenomena we see being the expression of this one All. Such is to be the monotheism of the future.

Science, in the pursuit of the constitution of things physical, pursues the right method in the study of ultimates. But science as to philosophy begins at the wrong end. You can ascertain the combinations of matter by this method, but you cannot build a world by analysis, or discover the law of God by disintegration. You can take a watch apart, count and name the pieces, but the watch is gone, and the secret of the maker is his secret still—his thought has escaped you. But if you accept the maker and study it in its related parts, his idea and its uses become clear. So we cannot find the principle of things by breaking them to pieces by the blows of analysis, but we may comprehend the purpose of nature by accepting the idea of its unseen power and reading by the light of manifested phenomena. It is the synthetic not the analytic method that investigation must follow in this direction, because that was the method of world building. Analysis is valuable in giving the support of facts to synthesis, by showing that matter, from its law of affinity and repulsion, is adapted to world building and individualization, but it usurps a place for which it is not adequate when it assumes to be the only mode of demonstration—or the primary mode. It can show that all matter must have been homogeneous because it can be reduced to that condition —proving the direct process by the inverse method. And this is all that science has been able to do.

And here, in this connection, it may be pertinent to refer to a few recent discoveries which remove the last refuge of materialism and the mechanical theory of worlds—the heretofore unanswerable argument against the ultimate theory of spirit. Reference is made to elemental matter. The chemist had found certain substances that refused to yield to his forces, and these he called elements, and assigned to them ultimate qualities. Anything that did not recognize these elementary things was not true. The *New Chemistry* was printed in 1874 and contains a list of sixty-three of these substances. The revised edition of that book is just out, prepared by the same author, in which this formidable list is swept away, and in his preface the author says: "Except in a very limited sense, the so-called elementary substances are now seen to be as truly compounded as any other substances, and it is manifest that their qualities must depend upon molecular structure, or on the resulting dynamical relations, as well as on the fundamental attributes of ultimate atoms. There is, therefore, no longer any reason for limiting the statement of the great fundamental law of definite proportions to the relation of elementary substance, and clearness of exposition is gained by giving the statement the widest possible scope."

And so goes down this support of the physical school as the interpreter of cosmic law. And it brings into the foreground the singularly ignored discovery of Crookes, to which reference was made in a paper read before this Academy in 1881, as to the fourth or radiant state of matter. The only reason that seems to exist for this long neglect of a discovery by the foremost investigator of his time, is probably found in the closing sentence of his remarkable paper: That it

brings us to the borderland between the material and that beyond, for which the great student had such strong partiality.

And here I will refer to one more fact, the bearing of which will be seen on the thought involved. That is that Edison has, in the face of the negative of materialistic science, succeeded in passing a current of electricity through a vacuum. This implies, in the opinion of this remarkable genius, to whom electricity seems a native element, that there is still a more subtile medium, universal in nature, which acts as an agent for the transmission of electricity, light, heat and magnetism, and that the results of his experiment may be almost revolutionary in the finer calculations of astronomical science.

Are there any more barriers remaining to the conception of the spiritual? Science has about passed the limit of special interest in mere physics by these discoveries of yesterday. Matter, motion, heat, light, magnetism, electricity and force as studies must now give way to what is shown to control them. The day of the dreamer is dawning, and the time of the "crank" is near at hand. We may now return to our subject more direct. We have seen that astronomy, biology, chemistry and electricity have given up secrets that change the whole field of investigation and challenge the human intellect to new paths of exploration.

We cavalierly dismiss the wisdom of the ancients as too grotesque for modern consideration. But, after all, may it not be their way of accounting for things as we comprehend it rather than the conception underlying? We replace astrology with astronomy and substitute chemistry for alchemy, but are we sure they did not apprehend the cause, the principle, better than we. For it is a fact that every step forward in our researches brings us nearer to the ancient mysteries. The mineral to them was sentient, it is magnetic with us—but with both the fact remains of endowment with a quality that we can express in no better way than to call it life.

The great trouble after all is from the want of thinking. It seems as if a theory was necessarily a centenarian, and must live so long, no matter how many new births may happen. Newton for twenty years doubted his own theory of gravity, and now it has to bear many burdens which never had his authority or sanction. The same is true as to evolution—many things being credited to Darwin that he never taught. The power of thinking possessed by these great masters seems not to have survived them, and their hypotheses, instead of being modified by new facts, have been made procrustean beds to which all new discoveries have been compelled to conform. Their disciples have been too much like the man who when facts differed with his theory, said: "So much the worse for the facts."

A certain school have assumed that there is no such thing as intelligence in the order of nature—because they know nothing of it. Another school assumes to know, absolutely, all about the nature of the intelligence. And if a fact differs from either assumption the fact does not exist. Between the two truth has had a hard struggle. The one has its standard in what it thinks was said thous-

ands of years ago—the other denies and rests on that negative as the all of knowledge in that direction. Between the two the thinker is visionary or an infidel—and all that can be discussed inside the limits of toleration or sanity is a jumble of formulas about either supernatural and miraculous things, or an utter denial of them, with chance as providence and annihilation as the only certainty. Without suggestion or coloring, these are the horns of the dilemma with which the recognized teachers confront poor humanity to-day. Beside these the so-called superstitions of the ancients were very gospels to the race.

The occult in this modern age, it will be perceived, is vastly narrowed from what it was in the time from which philosophy draws its inspiration. Aristotle is claimed by modern materialism as its prophet, yet the chief part, the soul of his system is ignored. His terminology has been borrowed, but when it refers to the principle of things, or the cause of the manifest, it is mythical, superstition and pagan vagary, while the manifest, or phenomenal is exalted as the all of his wonderful teaching. Occult has lost its etymological meaning and been consigned to witchcraft, conjuring, demonology and related things. But even here the thought of these ancients is being vindicated in the light of discoveries in magnetism. Mesmer taught a century ago, yet the schools have only accepted his facts within a very few years. But, as hypnotism, this rejected truth takes its place in the ranks of accepted fact, and one more occult force becomes knowledge.

And now we find only one more door remaining closed between us and the wisdom of the ancients, but before that stands modern science insisting that it is only a blind door in the solid wall of the unknowable—impassable and impenetrable. And in its watch it is relieved by theology, which as in all the centuries of progress, interposed its little standard of infallibility as a barrier before every new door of truth. But reason and progress persisted in forcing the locks and as the doors swung back new worlds of knowledge stood revealed—the occult became the known, the hidden the revealed, the unseen the understood. And so will it be now.

There is one mistake a great many well meaning people make; that the discovery of something they did not know, or believe, would change the whole aspect of the world. They seem to forget that facts have always been. These people labor under the delusion that the world was made according to their plan, forgetting that they only from time to time find out a truth as to the nature of things. And they often stand amazed that as their little lights go out, the sun and moon and stars still shine on. But the man of progress rests serene. He hails each new truth as something in the grand economy of the universe heretofore hidden to humanity, and he fearlessly swings open this blind door in the wall and steps forward into another world of higher and grander phenomena.

Now let us try this door. We have passed the former ones of astrology, alchemy, sorcery and magic, and found the light of astronomy, chemistry, magnetism, electricity and mesmerism, or psychology. Before us is the door of superstition, but as it opens we are ushered into the world of life. And again

we find we have been mistaken: That life instead of being a thing of miracle, induced by an act of external power beyond natural law, sustained and ended by similar agency, is simply a part of the eternal order, and of necessity co-existent and continuous with the cause of all. For the first time, so far as we know, we are able to apprehend the problem from strictly scientific methods, and to comprehend its necessary conditions from the analogies and logic of precedent knowledge—because science has led us up to it step by step. And as mesmerism has been admitted to the sacred circle of accepted science we will use it as the key to unlock this door.

What is mesmerism? Phenomenally it is the domination of one mind by another, from a state induced by physical methods—passes by the hand and analogous processes—all of which are based upon the passage of a magnetic current or force from the operator to the subject. And your pardon is once more asked for reminding you that in this description we are still in the domain of accepted science. The conditions are simple: Given a person of strong magnetic organization and a person of nervous conditions, and the one controls the other, makes him responsive to his mental moods, or to act as willed to do, despite volition or will to the contrary. This is not mental force alone, for often the subject is far superior in intellectual power to the operator, and as a rule mentality or brain power is not a quality of mesmeric operators. What is the power? Scientifically, a stronger magnetic current thrown from the operator over the subject, which current or force is evolved by the will of the operator from the brain, just in kind as the currents from a battery. This so generated current is thrown upon the brain of the subject, and for the time paralyzes the will, and the brain responds to the stronger force.

What is the medium for transmittal? And here is another occult thing, for as yet science can tell you but little as to the function of the nerves. Physiology can name all the principal nerves and map out their modifications; can locate the nerve centres and trace the vast net-work going out from them, but beyond this it can do little else. Now, in view of all the facts we know, what can the nerves be but electricals—not only conductors, but like glass, exciters of electricity. Here, then, we have the means perfected to perform exactly what we see. Here, too, we have the agent for these phenomena of living organisms. The normal action of the nerves conveys the magnetic forces of life or excites the electrical currents in a degree that supplies the regular uses of the organism. Excessive or abnormal action or impulse produces more powerful currents, and so we see that people under excitement speak with greater force, act with higher power and perform tasks with more ease and facility than in an unexcited state. This arises from nervous action, an augmented generation of electric power, which carried to the grand centre of the nervous system, the brain, gives to the man extra mental and physical force. While this exists more or less in all, its manifestation in individuals is of degree. Hence all cannot mesmerize, nor can all be mesmerized.

And here science can find explanation for what has ever been a mystery—

the cause of temperament—or of what are called nervous organizations and the reverse. Also for that unaccountable thing so often seen in life, the control or domination of one person over another. If the nervous system is sensitive to magnetic influence it responds more quickly to such conditions, and we say the person has but little firmness or persistence of purpose, while on the contrary is the nervous organization less sensitive, the possessor is enabled to use the force of his will to throw over the sensitive person a power to which it must yield. Or the better to handle the subject mentally, we invent terms to express the two conditions—the one is positive or the generator, the other negative or the passive recipient. It must be remembered that while this mode of operation may be suggestion, the premises are not—for science admits the nerves, the brain, the magnetic force and the result. All these are determined to be, and the phenomena apparent. Granting these, the method must be just as described—from all analogy cannot be otherwise. So another occult force emerges from its hiding place and takes its position with the known.

With your permission this blind door will now be passed, and in deference to the occasion and this presence, the attempt will be made to deal with what you regard as pure speculation, or with that which science treats as entirely occult—immortality and the possibility of knowing the fact.

It is useless to travel over the old argument as to matter and mind. Much of the world's philosophy has been an attempt to have us know that we cannot know anything. This definition should supplant the present one of metaphysics in our standard dictionaries. Happily, however, this is passing away, and ere long we shall be permitted to recognize ourselves. We have been bound with a scientific bond to ultimate atoms, with a force that no theologic dogma ever exercised over men's minds. These atoms are the mathematical units upon which science builds the universe—persistent, indestructible, indivisible and unchangeable in weight or volume. These inexorable atoms are next made to account for changes of volume. temperature, latent energy, and the still more incomprehensible change of chemical properties. Can we conceive an atom from scientific formula? It cannot have color—for light, which gives color, is a mode of motion. It is neither hot nor cold—for heat is also a mode of motion. It has neither electric or magnetic qualities for the same reason. It cannot have weight or extension, for weight is the mere play of attractive forces, and extension is only known as resistance, which is a manifestation of force. It can only have magnitude, and in this regard it is not appreciable or comprehensible. If the atom is this paradoxical thing, what must we say of a cosmic theory that rests solely and only on this inconceivable thing? If the atom is not, the theory built upon it is a fiction.

In this reference to the atom, the argument is not original, but condensed from high scientific sources. It is not denied that it has been of service to chemical science, as a working hypothesis, but some of the most distinguished names in experimental chemistry—among them Cournot and Sir Benjamin Brodie, professor of chemistry at Oxford—have declared it a hindrance rather than a help,

and that it has proved itself inadequate to deal with the complicated system of chemical facts. At best it stands as the x in hypothetical formula, but must not be recognized as a fundamental fact.

Until this settled we may be permitted to enjoy two things: One is that we are, and the other is that one of our attributes is common sense. This quality tells us that we can only observe phenomena and reason from them. To our knowing we find matter as the medium of all expression in nature. We find it unorganized and organized, as we term the two states—or living and dead. If the ultimate of what we call living is unknowable, the fact is known, and we must deal with it as we know it. Science has helped us to the last tangible condition of organized matter in bioplasm, and traced for us the process of growth. But it has not been able to seize the union of life with it, or to know how it is vitalized. Its methods have utterly failed to produce the vital substance, or to generate anything living. As far as we know, matter is not intelligent; it does not think and it cannot know. The intelligent principle must then be higher than matter, as it uses it. The least we can do is to recognize this duality. We cannot call it chance, for there is no element of chance in order, purpose, persistence and duration. It cannot be matter in motion by virtue of its material forces alone—for this is simply in logical desperation inventing perpetual motion, a recognized physical impossibility, or as one writer has it, producing a machine to lay an egg that will hatch.

We may as well lay up our yardsticks, our scales, our blow pipes, our test tubes and microscopes, and start where only the human intellect is capable of starting from—God. After all our theories, systems and philosophies, this is the only true and universal working hypothesis. All that is needed from this premise is to start right—or speaking scientifically, to interpret nature from her facts. Then our conception of the great cause will grow in harmonious and widening knowledge. If, as the world has so largely done in the past, we start with a self-imagined God, denying all facts in nature that conflict with that ideal, we must end just where science found denial of such a God imperative. But we must not imitate its error and supplant him by another self-conceived hypothesis as to the nature of things. Here, in these assumptions, of both sides, as to the great principle in nature, has been the mistake of the ages—the cause of all the so-called atheism, infidelity and materialism of the world. We find out what man is by what he does, what he says, and by the logic of his action. We do not form an idea of the man and then ignore the lesson of his acts, reject what he says, or set aside the logic of his conduct. If we do so we simply find that we have mistaken the man. Let us learn of God by like methods—the investigation of nature, its laws, phenomena and uses—and we shall find him in harmony with all. And what is of supreme importance to us, ourselves also in harmony.

The primal entity in the universe is intelligence—we call it spirit. It is superior to matter because matter is used by it. Our methods are inadequate to compass its source, but we may learn its purpose. We simply know it is, through our own conciousness, and that it controls and acts through our own organism. And

we see that all other being is acted on in like manner, or exhibits like phenomena. And we see that the phenomena are in power, extent and character, just in degree with organic structure and intelligence. Our reason then says, as these are all of like quality, only differing in degree of manifestation, that the force property or intelligence that we know to be in us, is the same in all else—or is one. And as we know that we are of both matter and intelligence, we are dual in constitution. The one we call matter and the other spirit—not that the names signify, but they are the tools we handle to express the conception.

Now, as we see matter without manifestation of spirit, we must accept the conclusion that the one is at least equal to the other, and as matter is known to be indestructible spirit must be also, and we call this quality immortal. If spirit does take on matter, as we see from our birth and growth, it must have had being before it did so. And if it had being before it manifested through matter, it cannot cease to be when the matter is worn out or destroyed as to that use. You may say this is not proved, but so we have said about a great many things that have been proved. To deny is not to prove the reverse. It may be the very best we can do with our faculties at this stage of our progressive development. We know a great many things that men three centuries ago said were impossible to be known, and our experience ought at least to teach us to be modest about setting limits to the knowable. There can be no doubt if we had not set up our own little standards of truth as infallible, and refused to look beyond, the world might have been far in advance of what it is to day. It is fair to assume that there is nothing necessary to our full happiness, our moral or intellectual needs in this life or for the life hereafter, but what we have the capacity to know, or that is not within our ability to obtain. To deny this is to assert the incompleteness of our creation—that we have the quality of want without the equivalent of satisfying—an absurdity on its face, and an impeachment of the infinite power and adaptation we see in all else in the universe. The one condition is that we seek the knowledge aright. As all we see and sense has its method of coming to our observation, we can find how it comes if we only seek in harmony with the law of that coming.

Now, if life, or spirit—the presence of which gives life—has the power of coming in connection with matter for the uses we recognize, is there any principle of logic that can make its coming impossible for other uses and by other methods? Surely the claim that it can has as reasonable ground to stand on as the most vital of our scientific assumptions, as has been shown. If it comes to stay through the modes of conception and growth, it ought to be capable of the lesser function of coming on a visit to the imprisoned spirit. If it has command of the forces of nature, or the elements of organization to direct, control, mould and express itself through the physical body for four-score years, there is no known obstacle to its coming into relation with the conditions in which it existed so long, after leaving them. To claim that it cannot is to exalt the conditions and powers of matter above those that gave it the power to first come. Or it

makes the future life inferior in state to this, which would be a reversal of all else we know of the universe.

What is the method of coming? In the case of the mesmeric example we see that one spirit in the body acts upon another spirit in the body, through what we call magnetism. If this is the medium for communication or contact, spiritually, in one case, does not all nature tell us it must be so in all cases? In the one case we see that manifestation by this means is the result of what we call will power—or in other words, spirit impulse. If the intelligence, the will and all spirit attributes survive the body, why can it not exert this will power or employ this impulse in one state as in the other? It is having them that is the controlling fact. There are certain limitations on this power in the physical form from what we call law—there must be limitations from the same cause in the other. Everything cannot be possible in the one condition more than in the other—for the fundamental fact is individuality, and this must have, to be a personality, its limitations of invasion. And here, perhaps, will be found the one great obstacle to a clearer understanding and a wider acceptance of intercourse between the two states of life by humanity. Our wrong teaching as to nature, as to matter and phenomena, and as to our conception of God, has also been against the comprehension of the relation between the two states of life.

Now, suppose we conceive God, not as a separated personality, ruling by behest, but as the universal principle of nature, his commands being eternal rules or law? That what we see was not made by him as a mere experiment, but is Him—by expression. As he employs matter for the expression of himself—life and intelligence—how could that expression come from the higher life other than by a universal law? We cannot conceive of its coming by one law, going by another and returning by a third. We must be under the one eternal law before coming, while here and hereafter. Manifestation, then, is only a thing of condition and degree—just as it is in this life. A man is superior in this life, morally, mentally, physically, just as the body he lives in is adapted to these uses—conditions being equal. This fact is as well known as any other connected with his organism. In the life to which he goes after this there must be corresponding degrees in power and capacity, else the fundamental law of progress could not find operation. And nature is prolific in these analogies if we would but see them. An uninstructed man would never believe the butterfly was the risen caterpillar; but the entomologist knows it is. The man who never saw the face or conversed with the spirit of his dead friend may not comprehend the fact, but the man who has can answer the question: "If a man die shall he live again?" It is in both cases a mere fact of knowing.

Pardon a digression here, for a few general observations. It is not necessary to express an opinion as to the religious beliefs of men. But there is one thing common to all: There is not, never was a religion among men, but was founded on the belief of the existence of man after death, and his return to this life as the evidence of that existence. The facts are the common property of all men in all ages, and better established than that Moses, Zoroaster, Confucius,

Buddha or Jesus ever lived. What these great teachers gave had this fact for their credentials. And upon this fact is based all the sanction for everything that is of value as to this life and of expectation hereafter by the millions of the race to-day. There is not one man in a million in civilization that really rejects it, and none outside that pale. The natural man is never a skeptic, for he always has the evidence, and has not the egotism to reject it.

The one great obstacle to the spread of this among educated and civilized men is this: That while his spiritual teachers dogmatically insist that it has been the fact in other times, they as oracularly assert that it is no longer so. They next assume that when it was so, it was the voice of God. That to deny this claim is sin, while to assert that it is so now is heresy. Reason, founded on knowledge in all departments of nature, tells intelligent men that one of these assertions must be untrue. Science knows there is a falsehood somewhere—and it has assumed that it is in the statement founded on tradition, because it finds so many other dogmatic claims untrue—and so it has rejected the whole.

Suppose we look at this question from the common sense historic view. Two thousand years ago, yes one thousand years ago, the fact of intercourse between the two states of life was universal among men. In what we call bible times it was recognized by prophet and philosopher alike. The only dispute was as to which was highest in authority. From the trials of power between Moses and Aaron and the magicians of Egypt, down to the appearance of the cross to Constantine, this was the question that divided men—not the existence of the fact. It was contemporaneous and universal. The monotheistic Hebrew recognized it and called it the manifestation and voice of God; the polytheistic Greek regarded it as a message from the gods. It was the same thing in both cases. This is the verdict of common sense, and if one was fact, both were facts, if one was false and a delusion, both must fall.

When religion became the state policy of emperors, kings and despots, it would not do for this voice to be uttered by anybody, and the fiction was invented that the day of "miracle" was closed, and that for all time to come man must receive instruction as to the future life from dogma, and not from the source that had given it in the past. So God was made a personal king to rule over all other kings, and man was to serve the king of kings by obedience to the temporal ruler who happened to be over him. And so the God of nature and his universal law of spiritual teaching were banished. This is not only the fact as reason apprehends it, but it is the literal fact as history records it. The agitation now is only the revival of what was once universal. And now science in the presence of facts it can no longer ignore, accepts what it calls "hypnotism," and for fear man may find that he is a spirit with immortal possibilities, it at once makes it the explanation of all the phenomena of seer, prophet and angelic visitation of the bible, the pagan oracles and the supramundane phenomena of the present. It is now somnambulism, nervous sensibility or unconcious cerebration induced by "molecular force." It don't matter that we don't know any more when this is said than we did when told that "life is the property of that which

lives"—it is scientific—there are the words, the words are things, and beyond them we don't know anything and you can't. And so we have the two teachers—the one that it was but is not, the other it is, but though we see we can never know. The newer thought meets both; it tells the dogmatist that if he is right as to the authority he rests on primarily, that authority can be found to-day as well as two and six thousand years ago. And to the scientist it says, if your facts are true, they tell that there is a higher power in man than mere molecular force, and that he is an intelligent being beyond his mere physical properties. If this view of things cannot stand, then all the claims of dogma, all the suppositions of science go for naught. The universe, physical, moral, spiritual, must be a whole, whether man has or has not the right conception in regard to it.

Once do away with these assumptions referred to, and the primitive knowledge as to life will be restored to man, nature will re-appear in all her gracious motherhood to humanity, and God be worshipped with an aspiration and beatitude to which the race has been a stranger. It will require a re-casting of creeds, but that which comes in their place will be purer, higher, grander, and satisfying to the soul of man.

It is not the purpose here to go beyond this limit, nor to dogmatize about the evidence, or doctrines and philosophy growing from this view of things. Only to present an argument from recognized facts of science and the premises of faith for the conclusion that there is nothing in either to forbid the student from investigating in this direction. To show that all barriers as to matter were being swept away by discovery and research, and that the theories held by men of science which shut out spirit from the problems of modern knowledge are rapidly disappearing before the march of demonstrated facts. Also, to point out that the facts of science itself have pushed the inquiry to the border of the unseen world; that we must question it to understand realities already in our possession, otherwise impossible of explanation. An intelligent mind can no longer maintain its position as such and ignore this inquiry—for all else has been exhausted. Science has piled hypothesis upon hypothesis to account for this and explain that, until its theories have undermined the very foundation upon which its whole structure rests. It is now rushing about blindly, denying, affirming, denouncing and embracing, but scarce a sun rises and sets but some assumption is exploded by new knowledge. Still it refuses to turn to the new light streaming in upon humanity, illuminating the minds of men with a fresh and wonderfully simple power. Theology too, thunders against the evidence of its own existence, clinging to its formulas as though the life of humanity would be buried under their crumbling walls. It seems to be terror-stricken that what it calls miracle should prove to be the law of creation, and that the light of inspiration and immortality shall, like the air, the sunlight and the seasons, be the possession of every human being by virtue of his being such.

This knowledge is open for all, and the privilege of acquiring it for himself, at first hands, is the one great boon that this movement of the age brings to humanity. Each for himself may look for it or not, as he pleases, and no one

has the right to say he shall or shall not. Nor has any power the right to compel or deter him,—the consequences are only to each and for each to bear. What has been said in this connection is to enforce, as it may, the truth that what has been in nature still is, that there is nothing in what is known to forbid or prevent the pursuit of knowledge in this direction, and that no authority has the prerogative to bar the aspiration of the soul for all the truth. We can repeat:

> "Yet these things were when no man did them know,
> And have from wisest ages hidden been,
> And latter times things more unknown shall show.
> Then why should witless man so much misween
> That nothing is but that which he has seen."

MINERALOGY.

THE IDENTIFICATION OF MINERALS.

A person's first thought on picking up some unknown mineral or rock from the roadside, the quarry, or the field, is—what is this? What is the name of this object? and, if he has no more knowledge of the mineral world than the majority of people, he will be unable to answer his query, unless the specimen should chance to be quartz, mica, or some such very common mineral.

After the student of mineralogy has advanced far enough in his studies to become somewhat familiar with the subject, he begins to ask himself, when examining some fragment of the mineral kingdom, of what is this object made? What is its composition? and lastly occurs the question, how was it made? This article concerns itself only with the first of these three questions. It is well, perhaps, to say here that, in order to acquire a knowledge of the physical peculiarities of minerals sufficient for their indentification, the student should familiarize himself, by frequent inspection, with the general appearance of all minerals that come under his observation, and especially the more common species, as quartz, feldspar, mica, hornblende, limestone. etc. It is very desirable for the amateur geologist to have a collection of his own, of typical specimens of fifty or a hundred of the more common minerals and rocks, which, by the way, cost very little. If this is not convenient, he should not fail to visit the mineralogical collection in the rooms of the Worcester Natural History Society, which contains, in addition to all the common minerals, many rare and beautiful specimens from all parts of the world. It is only by careful study of the specimens themselves, object lessons, as it were, that any substantial knowledge of them can be gained.

Minerals are identified, or determined, as mineralogists say, by first noting their physical peculiarities, and afterward ascertaining their chemical composition.

We will now consider the physical characters of minerals:

1. About the first characteristic of a mineral to engage our attention, is its color. Colors, as relating to minerals, are of two kinds, essential and non-essential. The essential color of a mineral is its color when in a pure state. The non-essential is mainly the color of the impurities contained in the mineral. The essential color is found by powdering the mineral or rubbing it on any hard surface, as unglazed porcelain. The powder thus obtained is called the streak, and although the non-essential color may vary greatly, its streak is always nearly uniform. A mineral shows its true color when powdered, for the same reason that muddy water becomes white when beaten into foam and made opaque.

The essential color or streak of limestone is white or grayish white; its non-essential colors range from red, green and yellow to blue, brown and black. Common feldspar (orthoclase) may be white, gray, flesh-red, or even green, as in Amazon stone, but its streak is uncolored.

Metallic minerals, those in which metallic elements predominate, are always opaque and generally have essential colors, while vitreous or glassy minerals, which are more or less transparent, often have non-essential colors, because we can see into them and discern the impurities. Magnetite (an ore of iron) is a metallic mineral, and its color and streak are both black.

2. Closely related to color is the property termed luster, by which is meant the quality of the light reflected by a mineral as determined by the character of its surface. The two principal kinds of luster are the metallic and vitreous. The former is the luster of all true metals, and of nearly all minerals which are chiefly composed of metallic elements. An example may be seen in galena. The vitreous luster is the luster of minerals in which the non-metallic elements preponderate, as in vitreous quartz. There are various other kinds of luster, as adamantine, the luster of the diamond; resinous, the luster of resin; pearly, like pearl, as talc, pearl spar; and silky, as satin spar. When luster is entirely wanting a mineral is said to be dull, as chalk and kaolin.

3. After the color, streak and luster have been determined, the hardness is the next property that commands attention. In minerals there are all grades of hardness, from talc, which is impressible by the finger-nail, to the diamond, the hardest of all known substances. To facilitate the determination of this characteristic a scale of hardness has been devised, as follows, beginning with the softest:

1. Talc.
2. Gypsum.
3. Calcite.
4. Fluorite.
5. Apatite.
6. Orthoclase.
7. Quartz.
8. Beryl or Topaz.
9. Corundum.
10. Diamond.

Of any two minerals that which scratches the other is the harder, and by testing an unknown mineral by those given in this scale its degree of hardness can be ascertained. For instance, if we have a specimen that scratches calcite, but is scratched by apatite, we estimate its hardness at 4, but if it should also be scratched by fluorite we would place it at 3.5. The hardness of all common

minerals, however, as nearly as we need to get it in order to identify them, can generally be determined without recourse to the scale. The hardness of common window-glass is about 6.5, and any mineral that will scratch it must be at least as hard as quartz, and any mineral that can be scratched by a knife cannot be much harder than 5.5. By the judicious use of the point of a knife and a piece of glass one can soon learn to estimate hardness well enough for practical purposes. In general, different specimens of the same mineral vary but little in hardness. There are exceptions to this rule, however, and some mineral species, as serpentine and calcite, vary greatly in this respect; the former ranging from 2.5 to 5.5, and the latter from 1 to 3.5.

4. The specific gravity or weight of minerals is one of their most constant characteristics. It is more difficult to discover, however, than hardness, and is therefore of less practical value as an aid in determining species. If the specimen is not too small, its weight can generally be estimated with sufficient accuracy for practical purposes by lifting it in the hand. Barytes or heavy spar can be readily distinguished from all minerals which it otherwise resembles by its much greater weight.

5. Most minerals occur more or less commonly in crystals, that is, in figures bounded by plane surfaces arranged regularly about a center. Minerals of the same species always crystallize in similar or allied shapes, and therefore the determination of the crystalline form is an important aid in identification. For instance, iron pyrites commonly crystallizes in cubes, thus rendering it easy to distinguish it from copper pyrites, which it somewhat resembles. Tourmaline and hornblende, when occurring in small fragments in rocks, are very similar in appearance, but the tourmaline can usually be distinguished by its long, slender, triangular crystals. In order to recognize any but the simpler forms of crystals a knowledge of crystallography, the science "which treats of the forms resulting from crystallization," is necessary, but as most minerals commonly occur uncrystallized, we are often obliged to depend upon other characteristics, and the determination of the crystalline form is seldom absolutely necessary.

6. Cleavage, or the tendency of a mineral to break along certain planes, is a property closely allied to the crystalline form, and is frequently useful in the identification of minerals. Common feldspar (orthoclase) can be distinguished from similar minerals by its peculiarity of breaking or cleaving in certain directions with a bright, even surface.

7. When a mineral does not occur, as is commonly the case, in distinct crystals, its general structure should be noted, whether it consists of an aggregate of fine grains like granular quartz, or forms a compact mass like flint or chalcedony. Notice if it is made up of a number of slender columns like some tourmaline, or of fine fibers like asbestos or satin spar. Sometimes a mineral has a lamellar structure, consisting of a succession of plates or leaves, like common mica. Again, it may be found in globular forms like marcasite, (white iron pyrites,) or in a shape resembling a bunch of grapes, termed botryoidal, like limonite or chalcedony. Minerals also occur coralloidal (coral-like) forms, as

aragonite, or dendritic (tree-like) shapes, as magnetite (magnetic iron ore). Other species occur as stalactites or stalagmites, as limestone.

There are also many other imitative shapes in which minerals are found, such as amygdaloidal, (almond-shaped,) reniform, (kidney-shaped,) capillary, (resembling a thread or hair,) reticulated, (net-like,) acicular, (resembling a needle,) etc. In short, a careful examination of the general structure and imitative shape, if any, of a mineral, will often lead to its identification without further trouble.

8. There are various other physical characters of minerals, such as magnetism, taste, odor, feel, tenacity and phosphorescence, that are often useful in their determination. For instance, magnetite can be distinguished from minerals which it otherwise resembles by its property of being attractable by a magnet, or magnetized knife-blade; native alum by its astringent taste; kaolin or clay by its peculiar odor; and the hydrous silicates,—talc, serpentine, and chlorite, by their smooth or greasy feel. When two pieces of quartz are rubbed against each other they will emit light, or are phosphorescent. This is best seen in the dark.

The determination of the physical characters of minerals is, generally speaking, sufficient for the identification of all common, and also many uncommon, species, but there are many others that need to be tested chemically before their identification is rendered certain. This treatment is also necessary when the chemical composition of a mineral is to be ascertained, or the exact proportion of metal in an ore of silver, lead, copper, etc., determined. This latter process is called assaying.

We will now speak of the chemical characters of minerals.

Treating the mineral with acid is usually the first step. Calcite or common limestone can be readily recognized by its lively effervescence when touched with hydrochloric (muriatic) acid, while in the mass, but dolomite or magnesian limestone will only effervesce when powdered. Other minerals require the use of strong or hot acid. In addition to hydrochloric, sulphuric and nitric acids are often used. By the employment of acids the degree of solubility is determined, the presence of carbonic acid detected, and various other results obtained. After treatment with acids come the blow-pipe tests. The mineral is placed upon charcoal and submitted to the action of the flame of an alcohol lamp or gas jet directed upon it by the blow-pipe. The degree of fusibility is noticed, the color of the flame noted, and also the character of the sublimates, and the odor of the escaping gases. The mineral is heated in open and closed glass tubes, and then mixed with the fluxes, soda, borax, and salt of phosphorus. By these and other methods of treatment, and reference to a set of tables on the determination of mineral species, the exact status of the specimen in hand is finally decided.

The quantitative analysis of minerals, by which the precise proportion of each of their chemical constituents is found, requires a still more careful examination and additional treatment. A few words on the identification of rocks will not, perhaps, be out of place. To ascertain the peculiar species to which a rock belongs, it is only necessary to identify its constituent minerals, as, if we find a rock to consist of an aggregate of the minerals quartz and orthoclase promiscu-

ously intermingled, we know it to be a binary granite; if it contains hornblende in addition, it is hornblendic granite. If a rock is composed of quartz and mica, it is mica schist; if a combination of hornblende and quartz, it is hornblende schist, and if it is simply a mass of grains of quartz firmly cemented together, we call it quartzite.

Many rocks, however, are so fine grained that it is impossible to distinguish the minerals of which they are made up, with the unaided eye. In such cases recourse is had to the microscope, which generally reveals the character of the constituent minerals without further trouble, but quite often we are obliged to go still further and cut off a thin section or slice of the rock. This slice is mounted on a slide and carefully examined with the microscope, notice being taken of the reflected, transmitted and polarized light, change of color and various other peculiarities. The object is to ascertain the crystalline form, if any, of the minute particles of the minerals constituting the rock, the color, luster, and any other character possible. The science which treats of the determination of rocks by this method is termed microscopic lithology. Most specimens, however, can be identified without the aid of the microscope, so that a knowledge of this branch of the science of rocks is not indispensable to the amateur geologist.

W. H. L.

PROCEEDINGS OF SOCIETIES.

SOCIAL SCIENCE CONVENTION OF KANSAS AND WESTERN MISSOURI—SIXTH ANNUAL SESSION.

The Social Science Club of Kansas and Western Missouri commenced its sixth annual meeting at Atchison, Kansas, on the 6th of November, the President, Mrs. C. H. Cushing, presiding. Reports were made by the various officers, new members elected and other routine business attended to, after which the welcoming address was made by Mrs. J. J. Ingalls and responded to by Mrs. Geo. A. Eddy.

Able papers were read in the various departments, viz. in the department of Sanitary Science by Mrs. Eliza K. Morgan, of Leavenworth, upon the "Human Foot;" and by Miss Deborah Longshore, upon "Muscle;" in the department of Natural Science by Mrs. L. M. Ward, of Ottawa, Kansas, entitled "A plea for the study of the Natural Sciences;" in the department of Philanthropy and Reform by Mrs. Anna F. Burbank, upon "Individual Reform," and by Mrs. Mary Palmer Reese, of Kansas City, entitled "Woman—Her position what she makes it;" in the department of Education by Mrs. William Tweedale, of Topeka, upon "Education considered from a Practical Stand-point;" in the

department of Literature by Mrs. S. W. H. Gardner, upon Superstition; in the Department of Art by Mrs. S. M. Ford, of Kansas City, upon "Art from a a practical stand-point;" in the department of Domestic Economy by Mrs. B. Gray, of Wyandotte, upon "How to Simplify Housekeeping;" in the department of History and Civil Government by Mrs. M. J. Kellogg, of Emporia, upon "Equal Wages for Equal Work," and in the department of Archæology by Mrs. H. M. Holden, of Kansas City, upon "The Lost Atlantis."

The Association was hospitably entertained by Mrs. J. J. Ingalls and other ladies of Atchison, and voted that the meeting had been a very gratifying success in every way.

We would gladly publish all of the above named articles in the REVIEW, but, as they would nearly fill the whole number, we must confine our selections to one or two written by ladies of our own city, which seem more legitimately to come within its scope.

"ART—FROM A PRACTICAL STANDPOINT."

MRS. S. M. FORD.

The art of ancient Egypt is something very far away from the Social Science club of Kansas and Missouri. Phidias, with all his power for evoking the glory and spendor of Grecian beauty, is remote from its aims and thoughts; it is doubtful if a disquisition on the comparative merits of Nicola Pisano and Michael Angelo would make a very lasting impession on it as a body, or that it would even grow wildly excited over the contested superiority of Missonier or Alma Tadema. But there is a phase of the art question which concerns us all most nearly, and which ought to be brought home to each one of our firesides, because those firesides are affected very sensibly by its neglect or attention. In these days of "Woman's Art Work," such a statement can excite no opposition, and one can easily imagine half a dozen young ladies from the immediate neighborhood of anywhere starting forward with such exclamations as "Why, yes, to be sure! You remember my tidy with the Graces painted on it!" or "My crazy quilt with 150 different stitches!" "Or my lovely model of grandpa's nose!" But how our sweet friends would open their eyes at the reply that nothing of this kind was hinted at in the previous observation; that most of their cherished productions are hideously in contradiction with all the rules of art, have nothing to do with art culture, and that in many cases their gentle originators would find better employment in riding tricicles than in sorting crewels?

For there is nothing more disheartening in the art prospects of womankind than the extent to which women devote themselves to "fancy work." One might say that the art developement of this country lies in the hands of its women, and how do they show their appreciation of their great taste? By crocheting afghans and painting impossible Venuses, apparently. The women in larger cities, who neither paint, model nor embroider, are decidedly the exception, for the

fashion of the day is for the feminine world to spend its leisure hours in the pursuit of art, though these same women seem not to have the slightest idea of making a study of what is to them only amusement.

They have, as a rule, no knowledge of the art of former centuries and epochs, almost none of that of to-day, their taste is fed and formed solely by the inartistic surroundings of American exteriors; they know nothing, or almost nothing, of drawing, perspective or coloring, are incapable of drawing the simplest object correctly from the life, and do not dream of originating either conceptions, plans, or even the worst rudimentary drawings for their work. No matter what kind of art work they do, it cannot help but be viciously executed, since it is begotten and bred up in ignorance, and it not only ruins the taste of its authors and observers, but occasions a waste of time which is frightful to contemplate, because it might have been so employed as to bring a rich return both to the individual and the world. The hours which women spend upon the fancy work called "art," are precious possibilities dropped into a gulf of oblivion, which swallows up not only the souls of the perpetrators but sometimes numberless other innocent and helpless ones dependent upon them for the consolations of an enlightenment, which to many human beings can only come from personal contact and inspiration.

I have heard of a woman who wears a whole dress of "rick-rack," and has no idea of the infamy sewed into it; of another who sends her children to a questionable kindergarten to "keep them out of mischief," while she spends hours of every week in embroidering designs copied from advertising cards, or in painting Cupids, heroes and goddesses, with muscles and members in such perplexing confusion that a Greek could only look at them and die. Many a woman ruins health and life, and perhaps deprives herself of the sweet blessings of motherhood for just such folly as this, and never wakes up to the fact that a real love of art and devotion to it would lift her into an intellectual region where each one of her follies and prejudices would assume a quite different aspect, and might draw her into the fields where the winds and breezes could blow away her frivolities and sweep into her mind a little of their own freshness.

"But what shall we do with ourselves?" says some fair devotee of art needlework, for in spite of eating cares and unskillful Bridgets, the women of to-day have more time to spend as they choose than did our grand-mothers. We answer, paint and sew, and pound brass, if need be, but do it intelligently, and with a wide-eyed independence which will put an effectual end to servile copying and ignorant imitation. There is, perhaps, no study among the many which women can pursue nowadays, which would be richer in results than that of art, rightly pursued, and none more unfortunate in its general results, as it is followed at present.

Every woman who wishes to do even the simplest painting or embroidery, should teach herself to draw with such skill as will enable her so to change and combine designs and patterns that she will not be forced to depend upon slavish copying for the idea and soul of her work. In any kind of art-work the charm

of individuality and originality is greater than all else, and in this, as in everything which helps a woman to rise above her natural dependence, is an incalculable benefit. The thousands of so-called "art-teachers" in the country, undoubtedly retard the possible art development of our corner of the world by constantly assuring their pupils: "You don't need to know anything about drawing, you can paint just as well by sort of working out the design with the brush, and then painting it in," etc., etc., as if the drawing were not the heart, the soul, the living foundation of every picture?

But aside from the drawing, there is another thing of equal importance, if not for the execution, at least for the inspiration, of any art work, from a bunch of violets to the "Death of Cæsar." And this is a knowledge of the growth and development of art in the world, a familiarity with the most beautiful things a man has executed, and some comprehension of their productive causes. There is no patient wood carver who will not gain new interest in his work by some knowledge of the quaint creations of the middle ages, the wealth of pictured wood with which Durer and Veit Stoss enriched the narrow streets and pointed gables of Nuremberg; not an enthusiastic crewel worker who will not work faster and dream fresher designs, if she knows something of the tapestries which the patient fingers of Matilda and her ladies made to bloom with the story of England's conquest, or of those more wonderful ones, for which the great Raphael himself made the designs. Even a simple baby-face is drawn better if one has in mind not only the sweet little cherubs which one sees upon the streets or in one's own home, but a miz-maze of all the divinity which Murrillo, Corregio, Francia, and a host of others have drawn from the child world. There is positively no end to the benefit of cultivation and intelligence in even the most elementary art-work, and if one could persuade Mr. Alma Tadema to compete with Mrs. Brown-Smith in making a crazy quilt, the effect of it would be felt immediately, for with that artist's knowledge of the color and form effects of the past and present, there could be no doubt as to who would bear away the prize.

"But," says some fair objector, "one can't learn all these things without going to Europe, and we cannot all afford to take a trip of such magnitude." Dear friend, the thoughtful observer of crewel roses would answer, you must do all this in order to appreciate a trip to Europe, and it can be very easily done. Books are so much cheaper than they were a few years ago, that any one who is willing to endure some deprivations in the way of dress for instance, can have a respectable art library, while the abundance of photographs of all pictures easily accessible, enables every one to become familiar with the works of the masters at small cost. Moreover one can obtain large carbon photographs at from three to six dollars a copy, which are really the most satisfactory reproductions of the old masters, because they represent all the cracks and defacements of the old canvases and give no false impression as to their preservation. Art culture is a very subtile thing. One can not get it from a few months sojourn on the continent, or by a hasty brushing up of knowledge in preparation therefor, it must be a slow growth fed by constant observation of good models, and this is why the carbon

photographs are such a boon to America. A few of them, with the addition of some good engravings and etchings hung upon the walls—not of the drawing room alone, unless one is a person of very elegant leisure and spends most of one's time there—but upon those of the sitting room, kitchen, and nursery, if need be, will be a constant source of elevation and refinement of taste. Few people realize how sensitive their own minds are to impressions, impressions too subtile to be felt or recorded at the time of receiving them. If they did they would be more careful of their own environments, and fewer Americans would rush through the British museum and the Louvre, naming the Elgin marbles and Venus of Milo "stumps," bringing home, one might add, no strong remembrance of foreign scenes, except the determination to serve wine with dinner henceforth.

But perhaps we are improving in regard to "environments." There is a great furore nowadays for artistic furnishing, a "craze" for Eastlake designs, painted tapestries, and bric-a-brac, without which the perfect mansion is believed to be very incomplete, and concerning which one sometimes feels like asking, is this all that constitutes the proper furnishing of our interiors? We hear very frequently the phrase, "O, she has such a lovely, artistic home"—a phrase which upon investigation is often found to mean a home where the ordinary accessories of curtains, hangings, ornaments and furniture generally are combined and grouped with unusual harmony, and where too frequently the frigidity of the perfection tells a sad tale of the extent to which the house is abandoned and forsaken by its owners and enjoyers, for the sake of preserving its treasures intact; for while the horrible parlor of our grandmothers is rapidly vanishing before the advance of civilization, the combination of poor servants and a desire for elegance, induces many a housekeeper to fill her whole lower floor with all the pretty things she can collect, after which, for the sake of keeping it in order, she deliberately shuts out the sun, the children, and that charm of her own occupancy which does more than anything else to render an apartment cozy and inviting, restricting her family—and especially the childish portion of it—to rooms devoid of ornament or pleasant aspect. Now is this all very wrong, but especially wrong in regard to the little ones, particularly if the owner of such a home is aware of the very decided difference which exists between prettiness and artistic beauty, between the artistic harmony of form and color which appeals only to the senses, and the high intellectual quality which appeals to and educates the loftiest part of our nature.

It is in this latter quality that a home should be artistic. Its walls should not only be softly and harmoniously frescoed and papered, but they should be covered—not ornamented only—with pictures which educate the senses by their beauty and rouse the purest sentiments by their silent and never ceasing appeals. Let the curtains, the furniture, the bric-a-brac be ever so beautiful, if the other element is lacking the individuality of the home is gone, for while an upholsterer of taste and intelligence can do all the rest for us, we can not hire any one to take the place of our own educated taste. In this country such home adornments

must consist largely of engravings, etchings and photographs, for few persons can afford to buy many paintings, and if these are not of the very highest order the reproductions are decidedly preferable. Again, in a home where there are children one should find as large a collection as possible of loose pictures and illustrated books, containing etchings and engravings, which the children must be allowed to handle as freely as they do their toys—books not intended for children, but such as a critical and cultured taste demands for its own enjoyment, for it is only by such constant, free and unwatched handling of precious materials, that the more precious child mind can get the food it needs to bring all its divinity to maturity. A child is even more moody than a grown person, and is not always in a receptive humor, when the mother is ready to take out the prized volumes and rare portfolios, and with many injunctions to "be careful" lay them before the childish eyes. All the intellectual doors a mother can open for her little ones must stand wide, and she must educate in herself a divine economy which will teach her that all the wear and tear of earthly fuel are nothing in comparison with the priceless fires to be fed by it, and that the little finger-marks in her valued books and pictures are the sure testimonials of unquenchable bright spots in the childish soul.

"But what is the use of all this fuss and feathers about a few pictures," cried one practical soul. "I shan't take all that trouble when I don't intend to be an artist, and what good will it do me to know a little something about the Sistine Madonna and the Laocoon?" But, dear friend, man is such a complex creature, and usually so stubborn in wickedness, that all the aids which can help him to rise above his natural animal level are worth trying. Plato rated art only fifth in the scale of good things which may elevate mankind, but we moderns, believing that art comes nearer than anything else to a visible illustration of those very unattainable ideals of which Plato is always preaching, place it among the very first of our aids to morality, because , if rightly studied and appreciated, it refines the tastes and makes the man less capable of coarse sinning, while used as a means of education, it keeps before the eyes and fastens in the mind the highest illustrations of purity, goodness and beauty.

As an educator for the body alone, art is worth introducing into every family, for there is no doubt that as a nation, Americans are sadly lacking in strength and grace of body, and there is not a household of young, growing children in the East or West, which would not profit, physically, by the daily observation of such figures as the Venus of Milo, the young Apollo with the lizard, or the Meleager of the Vatican, while the Venus di Medici would be a vivid object lesson to many a young girl who is dwarfing and deforming the figure which Mother Nature gave her by the wearing an article of dress which is worse than an eating cancer, because, as usually worn, it is eating the life and vitality out of half of the women in the land. A walk down Main Street in Kansas City is a painful experience to any one possessing a general idea of the internal structure of womanhood, together with even a moderate admiration for the soft flowing outlines of a well developed womanly form, for such a procession of coffin-shaped incapa-

bles as takes up its line of march there, would have driven Praxiteles mad! The expression, "coffin-shaped," is used advisedly, for the regulation womanly outline, which the fashionable dressmaker manufactures, refusing to fit a woman who will not allow herself to be so metamorphosed, is more like that of a coffin than anything and is as far removed as a coffin from all the bloom and beauty of nature. It is useless to talk to a woman who possesses this form, about her health, for in nine cases out of ten a fashionable woman prefers appearances to health. But convince her that she is not beautiful in this guise, so educate her taste that she recognizes the absurdity of her figure and apparel, and the battle of health and maternity would be won without a struggle. This is one of the things which art culture can do for America, and it is a thing so imperative that it would be worth the while of every father who possesses a family of blooming daughters, to invest a good share of his patrimony immediately in "casts"—cast of the beautiful old Greek sculpture which would teach his daughters how much nobler it is to stand before the world as large brained and perfectly developed women, than to cramp heart and soul to an ideal which can never go beyond the dressmaker's art.

ARCHÆOLOGY.

THE LOST ATLANTIS.[1]

MRS. H. M. HOLDEN.

If civilization be an inheritance, from what parent nation came the ancient skilled races whose handiwork and high civilization are traced with unmistakable identity from the Mediterranean nations of the Eastern Hemisphere to Mexico, Central America, Peru, and the mounds of the Mississippi Valley of the Western Hemisphere?

In the marked similarity of their traditions, religious beliefs, arts, customs implements, and weapons—is not some common source, some original home indicated?

Many inquiries are being pressed concerning the earliest people of the western world. A recent writer introduces his article with this question: "From what far off land came the primal pioneer to the shores of America?" And another: "Who were the earliest inhabitants of America?" Our savage red man no longer furnishes an answer to these questions. He is but the degraded relic of a noble ancestry whose arts and high civilization are traced back to the same period as that of the earliest civilization in the Old World. From a strict archæological standpoint the terms Old and New World are inapplicable as referring to the Eastern and Western Hemispheres. All historical students have

1. Read at the Social Science Convention of Kansas and Western Missouri, Nov. 7, 1884.

grown away from the idea that Columbus discovered a new world or continent. He but re-discovered an old one.

A writer in the *North American Review* finely expressed it: "The hands of the geological clock pointed to the same hour on both sides of the Atlantic." And that "the story of early man in America is but a part of the same and greater story of his first appearance on the earth."

Retrograde periods in the progress of races being conceded historical facts, we now ask the cause of the retrograde condition of the red man at the dawn of our history, and submit to the following answer, to-wit: They had lost all intercourse with their "parent land—their "first world"—"the drowned island"—"the lost Atlantis"—by the deluge as recorded in sacred and profane history. When the island sank into the sea the path of commerce was closed for "a lapse of 6,000 years." That this island did exist and was the cradle of civilization at a remote period, and was swallowed up in a great convulsion of nature, may yet, to many, seem legendary instead of authentic history, but, says an able writer: "There is an unbelief, which grows out of ignorance as well as a skepticism which is born of intelligence." Herodotus, it is said, was called "the father of liars" for his accounts of the wonders of the ancient civilization of the Nile and of Chaldæa. For a thousand years the stories of the buried cities, Pompeii and Herculaneum, were regarded as myths, but are now accepted facts in history, and cannot we, in turn, accept the testimony of eminent scholars whose lives are devoted to research, and to whom we are indebted for the historical knowledge we already possess? Even as Herodotus incurred the derision of his time, and in later times was held in high esteem by Schlegel, Buckle and their peers, so Plato's story of Atlantis, long considered fabulous, is now being interpreted as authentic history. And, says Ignatius Donnelly, "if confirmed by farther investigation, it will prove to be one of the most valuable records which have come down to us from antiquity."

In this new era for legends, does it seem otherwise than conclusive that in in an age before there were written records, marvelous events and heroic deeds should be handed down from sire to son, and, as years rolled on, be regarded as myths and "folk-tales"? An illustration of this view occurs in the dialogue between Critias and Socrates, in Plato's History of Atlantis. Says Critias: "Then listen, Socrates, to a strange tale, which is, however, certainly true, as Solon, who was the wisest of the seven sages, declared. He was a relative and great friend of my great grandfather, Dropidas, and Dropidas told Critias, my grandfather, who remembered and told us, that there were of old great and marvelous actions which have passed into oblivion through time and the destruction of the human race." In another place Critias says: "I will tell an old world story, which I heard from an old man, who was ninety years of age." Thus, it seems that the origin of legends might be traced back to a narrative of actual events.

The verification of Plato's legend is based on both ancient and modern evidence. From the striking identity in the traditions of the ancient nations on both sides of the Atlantic—each having a flood legend concerning a "lost island

in the sea," and this location of the island corresponding so accurately in each instance, modern scholars readily conclude that the Azores Islands in the Atlantic Ocean, west off the Straits of Gibraltar, are the mountain summits of the engulfed island. Their conclusions are based on the investigations made by different nations. In 1873, deep sea soundings were made by her majesty's ship "Challenger." In 1874, by the German frigate "Gazelle," and in 1877 by Commander Gorringe of the United States sloop "Gettysburg." Each investigation bears corroborative proof of the other. As stated, they mapped out the bottom of the Atlantic, discovering a great elevation of land in the exact location of Atlantis, as described in ancient legends. This elevation rises about 9,000 feet above the depths around it. And a writer in the *Scientific American* of July 28, 1877, says: "This elevation must have been once dry land, as its mountains and valleys could never have been produced in accordance with any laws for the deposition of sediment, nor by a submarine elevation, but on the contrary must have been produced by agencies acting above water level." The sea soundings further revealed that there were ridges of land connecting the island of Atlantis with Europe, Africa, North and South America. These ridges, says an English geologist, were but the skeleton of an ancient continent that once occupied the space of our Atlantic Ocean, and the island Atlantis was a remnant of this buried continent. These ridges, forming land communications between the two hemispheres explain the identity in the animals and plants. From able accounts, it has been proved that the horse originated in America; and in his wild state could never have been found in Europe and Asia but for these pathway ridges of land. We also read that the fossil remains of the camel are found in India, Africa, South America and in Kansas, and that the remains of the cave lion of Europe have been discovered in Natchez, Miss. Hence, the fact of the same species being found on both sides of the Atlantic indicates that they roamed from a common center. There are numerous other instances of absolute identity, but the limits of this paper forbid their mention.

The same similarity exists in the floral and vegetable kingdom. Otto Kuntz, a distinguished German botanist, says that the banana was found in America before the arrival of Columbus, and that before a plant becomes seedless it must have been under cultivation for a long period of years. He mentions other plants that could only have been transported by bulbs and cuttings, and that by the hand of civilized man—which again supports the theory that the colonies from Atlantis carried them to the east and to the west.

The race identity of the two hemisphere bears even stronger evidence of a common and an original home than the testimony of the flora and fauna. A writer in the *Magazine of American History* says the American Indian uses the same terms in his river names that were used by all of the aggressive races that over-ran and colonized Europe, Asia and Africa. Also, "the Indian names of our rivers belong to a period when one common language was known—when one dominant race ruled throughout the entire length and breadth of America." By analysis, the geographical nomenclature of the two hemispheres can be readily

traced by its roots or germs from one nation to another. From an extensive list we give a few instances: Genesee of New York, and Yenisei of Siberia, have the same origin. Saratonka of Russia corresponds with our Indian name Saratoga. Kyogia in Africa, with Cayuga in New York. The Indian name moose is moosa in Europe and Asia. Thus, continues the aforementioned writer, "we may be able to trace the Indian back through all of the historical eras represented by the Hebrew, Sanscrit, Celtic, Phœnician, Arabic, Persian, Indo-Germanic and even through the Greek into the bosom of the Roman." And, we will add, still farther, into the heart of Atlantis.

Modern culture, for many generations, paid generous tribute to Greece and Rome as the fountains of learning, but of late years the antiquity of Egyptian culture and magnificence is engrossing the interest of students of ancient history. Says one of these, "If ever full justice is done to the achievements of a vanished race, Greece and Rome will look small as compared with Egypt." "The people who made her what she was, and what she can never be again, have disappeared forever."

Modern Egypt bears not the faintest resemblance to ancient Egypt, before she was stamped out by the Persian, Arab, Roman and Turkish conquerers.

She was in the zenith of her learning and splendor, when all Europe was a savage wilderness. She possessed a highly organized social system when the rude savages that roamed over the sites where now are situated London, Paris and Berlin were engaged in fetich worship. And, at a much earlier period Grecian scholars went and sat at the feet of Egyptian masters. Woman's status, says eminent authority, was as high in the earliest days of Egypt as now in Europe and in our own country.

Historians give us no beginning or infancy for Egypt. She appears on the horizon of history in matchless maturity. Before the time of her first king, Menes, whose reign according to Lepsius, was 3,892 years B. C., Egypt was a "highly organized and governed community." Winchell says "her people had long been architects, sculptors, painters, mythologists and theologians before the era of Menes." We now ask, from what fountain greater than herself drew she this marvelous greatness? And as we progress, we continue to step backwards and answer, Atlantis.

That under the waters of the Atlantic Ocean lies the "parent nation" of grand old Egypt seems incontrovertible as we read the testimony of late researches on this subject. So, also, do ancient Mexico, Peru, Central America, and the mound-builders of the Mississippi Valley look back to buried Atlantis for the graves of their an cestors.

How can the extraordinary similarity of these prehistoric American nations to ancient Egypt, separated by so vast a distance of land and sea, be accounted for if they did not migrate from a common home? For we read that "the pyramids of Egypt are duplicated in Mexico, Central America, and Peru. As, also, are the temples, palaces, public works, agriculture, sculpture, painting, language and religion. And that Peru had invented suspension bridges thousands of years

before they were introduced into Europe." Humboldt pronounced the Peruvian roads among the most useful and stupendous ever executed by man. Her vast wealth and high civilization, in addition to the race and tongue similarities, give her rank with ancient Egypt as a sister colony from Atlantis. The mound-builders are identified with the bronze age in Europe, which age has furnished perplexing problems for European scientists. A bronze age implies a pre-existent age of copper and tin before the art of combining them was known, but the relics of such a period have not been found in Europe. Sir John Lubbock says in his "Pre-historic Times" that the absence of implements made either of copper or tin seems to indicate that the art of making bronze was introduced into, not invented, in Europe. The ancient Mexicans knew the art of making true bronze. Their identity with the Mound-Builders is easily established, and both are traced by their language and legends to Atlantis—hence what people but the Atlanteans, whose ships, docks, canals and commerce provoked the astonishment of all who felt the aggressions of their powerful and populous island, supplied all Europe with bronze in the bronze age!

Ignatius Donnelly says that "In 6,000 years the world made no advancement on the civilization it received from Atlantis—that modern civilization is Atlantean, and the inventive faculty of the present age is but taking up the thread of original thought where Atlantis dropped it thousands of years ago." We stand with abated breath at the startling assertions, but the evidence gleaned in their favor must be withheld, as we find, at the expiration of our time, that we are but on the threshold of our subject, and to tempt you to press on and into the subject, we give you a few hints of the feast that awaits you.

"That all of the ancient civilized nations of both hemispheres were colonies from Atlantis,"—"the land of the master race."

"That the gods and goddesses of the ancient Greeks, the Phœnicians, Hindos and Scandinavians were the kings, queens, and heroes of Atlantis."

"That Atlantis was the original seat of the Aryan or Indo-European family of nations, as well as the Semitic and possibly the Turanians."

"That Greek mythology is a confused recollection of real historical events."

"That the Phœnician alphabet, the parent of all alphabets, was derived from the Atlantean alphabet" and the Maya language spoken by the ancient people of Yucatan is the survival of the Atlantean alphabet.

A writer in the *Scientific American* says the last words of our Savior were in pure Maya tongue. "Eloi, Eloi, lami sabacthani" in that tongue is,—Now, now I sink; darkness comes over me." The bystanders, not understanding his language, thought he was calling on the Father in his hour of trial.

To resume: Genesis is said to contain a history of Atlantis, and that the sinking of this island was the scene of the Biblical deluge. That there was no gulf stream previous to this catastrophe.

"That this great event was the terminus of the glacial period, the barricade being removed, the "land locked ocean" of the north met the heated tropical waters, and produced climatic changes in Europe, and but for the mild waters of

the gulf stream flowing around the submarine elevation of the buried island, it is said the British Islands would scarcely be habitable.

Thus the authentication of Plato's story opens up a wide field for new thoughts in the scientific realm as well as that of secular and sacred history, and we may grow into the belief that as once "All roads led to Rome," now all lines lead to Atlantis!!

BURIED CITIES.

All that tread
The globe are but a handful to the tribes
That slumber in its bosom.

So wrote the pensive Bryant, and every year since has but emphasized the saying. Of the numbers of the human race in past ages we can form but little idea, even from estimates, and it is almost equally difficult to conjecture the number, size and importance of the buried cities which exist in every part of the earth. Even in this country, where everything seems so new and fresh, cities are built upon the ruins of their predecessors, these having been buried so long as to leave not the least indication by which their inhabitants can be identified, and we are, therefore, left in utter ignorance who they were, whence they came and what became of them. In this part of the continent their cemeteries remain so extensive as to indicate a vast population, and in the valley of the Ohio and its tributaries their fortifications of comprehensive plan and vast extent are still to be seen, but that is all. In Mexico buried cities are found in such numbers as to give a most exalted idea of the wealth, numbers and character of population that could crowd into the country; while in Central America and Yucatan, it has been said that buried cities are more numerous than living inhabitants. This is probably an exaggeration, but the explorer may well be excused for a liveliness of imagination when he finds it almost impossible to penetrate the jungle a mile in any direction without coming upon the ruins of a little fortified town, a palace or a temple. In Peru and along the west coast of South America, buried cities are far in the majority over the cities of the present day. The difference between these buried cities of the American Continent and those of the Old World is found in the fact that the latter have a history while the former have none. If we could trace the history of the cities of our own continent back to the date of their founding, and recall the names of the now unknown heroes whose exploits made themselves and their cities alike famous, we would naturally feel a pride in the ruins of America such as is now felt by an intelligent Greek in the ruins of his own country. But this is not only at present impossible, but there is little likelihood of its ever being done in the future. The American races were not remarkable for their records, and we have, therefore, small prospect of the recovery of much, if any more of the annals of ages which preceded our own.

The ancient cities of Egypt are, for the most part, buried literally as well as figuratively, as the annual overflow of the Nile brings down from one to eight inches of sediment, and this is deposited over the entire valley. When the cities were inhabited, the floods were kept from them by means of dikes, but after war and pestilence had depopulated the entire country, the river every year swept over palace and temple and tomb, and now the cities of the Pharaohs must often be looked for under twenty feet of soil. The present city of Alexandria, for instance, is builded on the ruins of the city of the same name, founded by Alexander. This was, in its day, second only to Rome, had over 4,000 palaces and innumerable schools, colleges and art collections. It was the commercial center of the world, standing midway between the east and the west. In ancient as in modern times, it commanded the Suez Canal. This is no new enterprise of our own times. It is recorded that a canal was cut between the Red Sea and the Nile by Rameses II., B. C. 1344, though some historical records place the date a century earlier in the time of Joseph. Herodotus tells of the enlargement of this canal 800 years later; the Emperor Trajan, still later, again restored it, and it was kept open till destroyed by the Arab caliphs. A few miles south of Alexandria is Cairo, and a little south of Cairo are to be found the ruins of Heliopolis, a city known in Scripture as On. Here was once the great Temple of the Sun, where the Phœnix was consumed; here Moses was educated and many centuries later Plato and other distinguished Greeks. Of this vast city, but one stone, an obelisk seventy feet high and six feet square at the base, remains standing. The rest is beneath the alluvium brought down by the Nile. Near the old obelisk is the "Fountain of the Sun," the only living spring in Egypt, which furnished the temple with water 4,000 years ago. Not far from Helipolis are the Pyramids, of which seventy are still standing in the Nile Valley. The base of largest of these covers considerably more ground than four St. Louis squares, and the pyramid is more than three times as high as the court house dome. The latest theory in regard the great Pyramid is that it was built by order of Joseph during the seven years' famine to find employment for the people; that he was buried in it, and that the huge empty sarcophagus found in its innermost chamber once contained his body, which was removed by the Hebrews when they left the country.

A little south of the pyramids is Memphis, the Noph of Scripture, founded by the first king who ever ruled over Egypt, and for a thousand years the capital. Here Joseph ruled and Pharaoh dwelt, and here all the magnificence of the old monarchy was displayed. The embankments which once protected the city against the river have long since been swept away, and the alluvial deposits of twenty centuries have covered from sight almost every relic of past grandeur. When the English army takes its course up the Nile next month the soldiers will see a few blocks of granite, one or two mounds of sun-dried brick and the fragments of a colossal statue of Rameses II., lying with the face in a pool of water, as if ashamed of the present condition of the country. This statue was almost entitled to be considered one of the wonders of the world. It was over fifty feet

high, cut from a single block, and computed to weigh over seventy-five tons. Back of the spot where once Memphis stood lies the largest and oldest cemetery in the world. It is over twenty miles long, from six to eighteen miles in breadth, and is estimated to contain the remains of not less than 25,000,000 people. A recent writer says that it is impossible to go 100 feet without seeing skulls or other bones, while the limbs of mummies here and there protrude from the ground. In the limestone rock that underlies the desert everywhere there are innumerable pits, evidently for the burial of the middle and lower classes, and in these the bodies are stacked up like cordword, six or eight courses deep, all carefully embalmed, and looking as fresh as if placed there yesterday. The most revolting thing about the present condition of the cemetery is the fact that the natives of the country may be seen any day using the bodies of their ancestors for fuel and then employing the ashes to fertilize their fields. In this cemetery are also the burial places and sarcophagi of the sacred bulls of the Egyptians. Hundreds of these sarcophagi have been unearthed, each sufficient in size to contain the body of a large bull, and each hewn from a single block of granite. The temple which once stood over the vaults containing the mummies of the bulls was for ages buried under seventy feet of sand, but has recently been unearthed sufficiently to show its great extent and what must have been an unexampled splendor. The secret of the remarkable care in preserving the bodies of both man and beasts is found in the fact that the Egyptians regarded this life as transitory, but the grave as an eternal abiding-place.

The English army, from the day of its entrance into Egypt to its arrival at Khartoum, will steam through a continual double line of buried cities on both sides of the River Nile. After Memphis, with its great cemetery, has been passed a number of smaller cities follow each other in quick succession, their local names and traditions being well preserved, but there is no place of great importance until Thebes, 600 miles from the sea, is reached. This was the capital of Upper Egypt, was built on both sides of the Nile, and from the numerous canals seems to have been a sort of ancient Venice. The remains of two huge temples comprise all that now remain of the city, which take their names from two local villages, Karnak and Luxor. The Exposition building at New Orleans covers, it is said, an area of nearly thirty acres, and is a temporary building of glass and iron, but the great temple of Jupiter Ammon at Karnak had a covered area of forty acres; the temple enclosure was ninety acres in extent, and of all the thousands of columns that enter into the structure no two are alike. There were many halls in this temple 350 feet long by half that in breadth, and the entire edifice, in extent and grandeur, it is believed, surpassed any other creation of man. It is especially to be remembered that this triumph architecture was erected in the days of Joseph, and was the center of a system of smaller temples which surrounded it for several miles in every direction. The frontier city of ancient Egypt was Assouan, the present city of this name being built on its predecessor, which lies many feet beneath the sand. The old Assouan is specially famous for its inscriptions, many important records having been recov-

ered here. Near the city is the Island of Philæ, the last resort of idolatry in Egypt and in the Roman empire. Here Isis and Osiris were worshipped for over an hundred years after the imperial decrees abolishing the old religions and substituting Christianity in their stead. The most wonderful thing about all the Egyptian ruins is the apparent ease with which the ancient architects and engineers handled the huge blocks of granite, as if they were no heavier than so many bricks. The utter worthlessness of human life and effort in those days is shown by the excessive labor bestowed on the statues, columns and other monumental works, the cost of which to-day, at our present rates, would exhaust the treasury of all the powers of Europe.

Arabia Petra, or the Rocky Arabia, was until comparatively recent times, believed to be a desert even more uninhabitable than the sandy districts, but the investigations of the present century have shown that it once supported a vast population and had a great number of strongly fortified and peculiarly built cities. About four years ago Captain Burton was sent out to explore the region east of the Red Sea and found the lost cities of the Midianites, mentioned in Scripture, and near them very extensive gold mines, which bore evidence of great antiquity, and less than two years ago he took out a colony to re-occupy these cities and work those mines which he considers to be the veritable Ophir of Solomon's time. Petra was first inhabited by cave-dwellers, who gradually improved upon their excavations until the ruins of that district are now among the most remarkable relics of the past. Temples, tombs, palaces, fortifications, and private dwellings are all, without exception, excavated from the sides of high cliffs, and thus form unique structures, the like of which is not elsewhere known. The peculiar architecture is suggested by the character of the country, which is rent into vast chasms 200 or 300 feet broad, and having perpendicular sides of sandstone and limestone. The great cities of this region are always in these chasms, and the ruins of the rock-hewn edifices extend often for many miles. Passing through Arabia and entering Palestine the most notable list of buried cities is found in the capital. The heights of Jerusalem were first held by the Jebusites, who had a fortified city there; then taken by David, who destroyed the city and built another on its ruins. Since then the city has passed through many sieges, and has been time after time destroyed, another rising on its ashes, until the original Jerusalem of David is now many feet underground. The city has been held in turn by the Jews, Assyrians, Persians, Egyptians, Greeks, Romans, Saracens, Crusaders, and Turks, and each change of government was attended with more or less violence and destruction of property. No less than six Jerusalems, one above the other, have been counted by those who sink their shafts for the purpose of making scientific examinations of the ruins. The workmanship of the Jerusalem of Solomon's time bears favorable comparison with that of Greece, Rome or Egypt. In the temple platforms there are found blocks of solid granite forty feet long, ten feet broad and six feet thick, laid upon each other, and fitted so nicely that it is sometimes almost impossible to discover the joint, increasing our amazement at the engineering skill that

could accomplish such wonders. It is impossible to dig a well in any part of the city without having to pass through broken columns, walls, streets, and ruins of every kind for nearly 200 feet before coming to the original soil.

Palestine is almost as much a country of buried cities as Egypt. Some of the most notable of these are the remains of cities rebuilt by Herod the Great, who was an indefatigable architect and levied the most merciless taxes on his people in order to build palaces and monuments to his own vanity. Among the most notable of the small but magnificent cities he built were the Herodium, a fortified country seat, and Machaerus, beyond the Jordan, a palace with surrounding houses, infamous under a later Herod as the scene of the murder of John the Baptist. Hebron, the City of Abraham, is now identified chiefly by the cave in which, according to tradition, lay the bones of the Patriarch and his family. Quite as interesting are the long buried and forgotten, but recently recovered cities of the Philistines, which, though occupying a territory only about half that of St. Louis County, fill more pages in Biblical history than many numerously populated capitals. The Philistine cities are remarkable for the massiveness of their ruins, the doorways being constructed usually of three huge stones, two perpendicular, and the third laid across them. Acre, in all ages celebrated for its strength, was the point where Napoleon received his first check in his Egyptian expedition, and the ruins of half a dozen cities here lie one above the other, while Cæsarea, in the time of Paul the capital of Judea, was lost for ages, and recovered only through the fact of the name being retained in the local traditions of the Bedouins. Jericho, so famous for the concert performance of the trumpets was lost from that day, and to the present can not certainly be located, but is not alone in this respect, since there are hundreds of other cities in Palestine whose history we know better than their geographical position. The most notable of all, however, are the Cities of the Plains, which were destroyed by volcanic eruption when the Dead Sea was formed. Deep down beneath the Dead Sea ruins of great extent may still be seen, suggesting that these cities were not only large but densely populated also, while the character of the surrounding country all goes to show that the Biblical account of the catastrophe was substantially correct. America is not alone in having ruins which possess neither name nor history. Such wonderful cities as Nineveh and Babylon, and the extensive cities of Persia and Mesopotamia are lost and found, and books are printed by the score about them, while moralists muse over the fate of the nations who once rejoiced in them; but it is infinitely more saddening to remember that ruins, covering many square miles have been found in the regions of Western Asia, showing the existence of vast populations who have perished from history so absolutely that not even a name or a trace survives. The land of Moab, east of the Jordan, is full of cities for hundreds of miles, but not a name remains to tell of those who built and inhabited them. On Mount Nebo there are the ruins of a great city not laid down in any map; who built it, who lived in it are unknown. The northern part of Palestine is almost equally rich in ruins which antedate the time of the Jews, but no antiquarian is able to assign hem either a date or a population.—*Globe-Democrat.*

ASTRONOMY.

SUN AND PLANETS FOR DECEMBER, 1884.

W. DAWSON, SPICELAND, IND.

As stated in the November REVIEW, the Sun's R. A. on the 30th was 16 h. 27 m. Hence on December 1st it will be 16 h. 33 m.; and on 31st 18 h. 46 m. The increase being somewhat more than four minutes a day is caused by the Sun moving faster on account of being nearer the Earth than it was near the middle of the year—speaking of *apparent* motion caused by real motion of the Earth. On December 21st at 4 o'clock in the morning the Sun's R. A. is just 18 h.; when it is farthest south (23° 27′). This is the shortest day, and the beginning of winter season. It will be 9 h. 10 m. long in 40° north latitude—longer south of this latitude, and shorter north of it.

At this writing (November 8th) the Sun appears again without spots—the third time in more than four years. The other two times were February 23d and May 27, 1883.

Those who study the westward motion of the stars will observe new constellations in the east week after week; and occasionally a planet appearing earlier than it did in the Autumn time.

On December 1st, at 7 P. M., the Pleiades are three hours high; Aldebaran nearly one hour below; and the Belt of Orion just rising in the east. Capella is away north of the Seven-stars, and Saturn below—making nearly an equilateral triangle with Pleiades and Capella. Jupiter rises about 11 P. M. during the first week of December; being a fine morning star. Venus rises about 4 A. M.—still bright, though waning. Mercury is an evening star this month; being at greatest elongation east on the 17th when it may be visible to the naked eye, though too far south (of west) to be conspicuous. It will be in conjuction with Mars on the 4th and also on the 29th.

The Moon will pass over a fourth magnitude star near 8 P. M. December 4th, and another one near 7 P. M. on the 22d. Both these will be interesting phenomena; and may be observed with very small telescopes—if the sky is clear.

METEOROLOGY.

THE PANAMA CANAL AND ITS POSSIBLE INFLUENCE UPON THE OCEAN CURRENTS AND UPON CLIMATE.

M. O. BALDWIN, M. D.

Referring to the above topic it is hardly necessary to say that the attention of the whole civilized world is, and deservedly so, directed at the present time to this great work and the benefits to commerce and civilization which will result therefrom.

It is not the purpose of the writer to treat of these, but to direct attention to the possible physical changes upon the earth's surface, which may be brought about by the completion of this canal.

The surface of the ocean on the Pacific side of the Isthmus is about fifteen feet higher than it is on the side of the Atlantic. This elevation of the waters of the Pacific above those of the Atlantic is maintained, it is probable, by the peculiar direction of the Pacific Ocean currents, which, while they carry forward to this point very great bodies of water, impede, and to a great extent, obstruct their return. The consequence of this must be that upon the completion of the canal, which is to be, it is understood, a tide water canal, there will be created a current from the west eastward, through the Isthmus.

The length of the canal will be about thirty-three miles, consequently there will result a fall approaching closely six inches per mile. The pressure of so great a body of water as is found in the Pacific, will give to this current in the canal a much greater rapidity than will exist in the current of a stream wherein we have the same degree of inclination. The result of this will be that the shores and bottom of the canal will be rapidly cut away.

Now let us consider briefly the currents of the ocean. There exists in the Pacific Ocean the great Japanese current, which sweeps from the coast of Japan northward and is divided upon the Aleutian Islands, on the coast of Alaska, a portion passing through Behring Straits and a portion finding its way down the western coast of the continent as far south as Central America, where it is deflected westwardly to join and again return with the currents from the South Pacific which are diverted from Australia and the Phillipine Islands and form a current which passes directly eastward to the Isthmus of Panama. This current in its passage eastward is joined by yet other currents from the great South Pacific currents which sweep up the west coast of South America, and together these form the great equatorial counter-current, and the entire force of this mighty stream is broken and expended upon the western shores of the Isthmus.

It is an evident condition that these ocean currents are directed in their course by the coast barriers with which they are brought in contact. If then, these barriers are by any means removed or changed, there will result a corresponding change in the direction of the currents.

We have then this condition, with the waters of the Pacific already at a considerable elevation above those of the Atlantic, a current from the west eastward seems inevitable, and with the added force which will be thrown in by the currents from the Pacific, the canal must be rapidly worn away until it is probable a considerable portion of the Isthmus will have been destroyed, and the great Pacific current, the force of which is now expended upon the western shores of the Isthmus, will find its way through into the Gulf and be joined to the Gulf Stream.

Should this be the result we can only expect that the great thermal currents from the Pacific, which have heretofore so greatly modified the climate of our Pacific Coast will undergo a change in their directions and the great body of heated waters finding its way through the Isthmus will pass northward with the Gulf Stream along our Atlantic Coast until it is directed upon the coast of Newfoundland and crossing the Atlantic it passes the shores of Great Britain and Iceland, expending itself and upon the frigid shores of northwestern Europe, will carry with it an elevation of temperature which will modify to a great extent the climate of those regions.

It is a well known fact that an extended portion of the Arctic world has been at some time habitable and inhabited. This is shown by the finding so frequently the remains of tropical plants and animals in the far north. It is equally known that great convulsions of nature have taken place whereby continents and oceans and ocean currents have been changed, and these conditions have brought about these great changes in climates. It cannot then be considered an unreasonable hypothesis, that the results which have followed natural causes shall also succeed artificial means when the elements necessary are at hand.

Permit a digression, to direct attention to the fact, as has been indicated above, that the current of this canal will be such that in the course of time it will result in the destruction of a considerable portion of the Isthmus. In that case the canal company will find a difficulty in making the investment a source of profit, as the canal will soon have overreached their boundaries, and will become a public highway, a great waterway for the shipping of the world.

THE ATMOSPHERIC HAZE OF 1883 AND 1884.

W. H. PRATT, DAVENPORT, IOWA.

The long continued prevalence of the "red skies" constitutes a phenomenon which at least in point of duration is quite unprecedented. As the months pass and this wonderful effect has not faded away as was expected, the subject assumes

a deeper significance and greater interest, and it is felt that the theories advanced and ably maintained by prominent astromomers and physicists are probably insufficient and untenable.

It was known from actual observation that clouds of volcanic dust could produce, temporarily, various and brilliant colors in the atmospheric reflections. It seemed possible, even plausible, that a comparatively immense volume of such dust projected into the atmosphere by the Krakatoa eruption, might remain suspended for a considerable period, gradually settling to the earth and the effect entirely disappearing within a few months. Such, however, has not been the case.

Over twelve months have passed and although the intensity and duration of the "afterglow" subsided considerably after two or three months, it has since that time continued with considerable uniformity. The dust theory has been largely supported by the discovery, as reported in different localities, of dust similar in appearance to that from the volcano, but we should not forget that this "meteoric dust" had been collected and examined in many places long before the outburst of Krakatoa. The coincidence in point of time—these appearances having commenced soon after the terrible convulsion—has perhaps been in reality the principal reason for attributing their origin to that event.

The fact of the observation of the phenomenon successively at points more and more remote westward from the Indian Ocean has also been cited as favoring that view; but such progression in the phenomenon would probably be the case whatever the cause which produced it, and the observations are too incomplete and uncertain to be at all conclusive. It is becoming very difficult to believe that the bowels of the earth have been so suddenly emptied to such an extent as the phenomena would demand upon that theory, or that the pulverized obsidian or whatever the discharge may be, could remain permanently in suspension. It therefore looks as if that theory must be abandoned.

One other opinion has been advanced and strongly advocated by a few scientific and many very unscientific writers, viz: that the phenomena are due to the presence of aqueous vapor in the atmosphere. They seem, without exception, to have quite forgotten that the same appearances have not been of common occurrence hitherto and must therefore be accounted for if at all, by some new or very unusual conditions.

A communication published in the November number of the REVIEW advocates this view. The writer assumes that the coloration is produced wholly by the moisture in the atmosphere, and curiously enough, that the *less* the quantity of moisture, the *greater* the effect produced! That would seem to be sufficient at once to settle that theory so far as his argument is concerned. His first remark also, concerning the "great commotion" produced in the scientific world, though greatly exaggerating that "commotion," shows that he is aware that the event is something new and altogether unusual, which aqueous vapor in great and small quantities certainly is not. Mr. Noyes suggests no recent change in terrestrial conditions except the development of the modern "Weather-Map." This, as he

very justly remarks is "a new thing." "One of its special beauties" he adds is "that it shows that nature is never twice alike." It will probably occur to every reader that he has heard that remark before the Weather-Map was brought to its present perfection; that is not a new revelation by several thousand years, and in fact has been a truism in all ages.

Doubtless the Weather-Map as now drawn gives a very instructive, graphic representation of the conditions of the atmosphere and the progress of storms, but it is no disparagement of its excellences to say that it has not produced the remarkable sunsets and sunrises and hazy skies of the past year. nor has it at all explained their sudden appearance and continuance, nor their non-occurrence in previous years. He remarks that "here the year 1883 was conspicuous for a prevalence of high-barometer." How then did the color-effect not appear until the last two or three months of that year, the highest monthly averages of barometer of the year having occurred in January and February, seven or eight months before? And why continue ever since?

In fact, however, the Signal Service record at Davenport shows the average height of barometer for eleven years next preceding January 1, 1883, to have been 29.368 inches, while for the year during which the color displays have prevailed, viz.: from November 1, 1883, to November 1, 1884, it has been 29.362 inches; six one-thousandths of an inch *below* the average of those eleven years. That seems to dispose of the theory of "High" as a producing cause.

Doubtless the extremes of maxima and minima of barometric pressure and atmospheric humidity have been as great during the past ages when there were no instruments to measure, nor "Weather-Maps" to illustrate them, as recently, and, as like causes produce like effects, had these conditions been adequate to produce the phenomena, the latter could not have been unfrequent.

The wonderful phenomena in question indicate a sudden and permanent, or at least a lasting change in the condition of our atmosphere, for the origin of which we should perhaps look beyond terrestrial operations, either to peculiar cosmic circumstances or to the progress of some secular changes in our system. When we remember that there are thousands of comets and unnumbered nebulæ, both of which vary from masses of immense extent and brilliancy to such as are scarcely observable with the most powerful instruments, we must believe that there are still almost infinite numbers of masses of nebulous matter, such as that of which comets are composed, not of sufficient size and not as yet sufficiently condensed to become visible. Judging from the comets themselves we must conclude that these small and highly rarified nebulæ are moving through space in all directions. Under these conditions it would be scarcely strange if one of these stray masses should sometimes come so near one of the planets as to be arrested in its flight, and compelled by the mighty power of gravitation to accompany its captor. Indeed, it would be remarkable if this should not sometimes occur.

Should the earth in its course pass near one of these highly attenuated bodies

whose momemtum is almost nothing, the latter must necessarily be caught in our atmosphere and carried along with us. If the repulsion between its particles which had hitherto prevented condensation continued to exist, the filmy mass would gradually spread through or over the earth's atmosphere, attending it as an envelope for some indefinite period, perhaps ultimately to be wholly absorbed. This cosmical matter floating in the upper air or above it would doubtless affect the sun's rays by reflection and refraction as well as directly obstructing them to some extent. It might also modify the structure of the atmosphere itself so as to cause the ordinary constituents of the air to act differently in the transmission of light. That it does constantly obstruct, decompose and reflect the sun's rays in a considerable degree is plainly shown by several facts which are matters of common observation.

1st. On all days when the sky is free from clouds or nearly so, the whole atmosphere in the vicinity of the sun's direction and to the extent of sixty or ninety degrees each way, including fully one half of the visible heavens, shows a whitish haze of dazzling brightness near the sun and diminishing gradually in all directions. On the clearest days this halo around the sun takes a more decided form and color: immediately around the sun an area of intense whiteness, surrounded by a broad ring of reddish brown color. Having spent the past summer on the dry plains of Dakota I have observed the above described appearance very strongly marked throughout the season.

2d. The portions of the sky more remote from the sun and opposite to it have *never*, during the past twelve months exhibited the clear "ethereal blue" so common and so beautiful in clear weather at all seasons of all preceding years. It now constantly presents, at the brighest, but a dull bluish lead color, and

3d. This condition is further shown by the following from the report in *Science*, page 295, of the proceedings of the Astronomical Section of the American Association for the Advancement of Science at the recent meeting at Philadelphia. "One very interesting statement of Mr. Swift to the effect that there had not been a first rate clear sky since the red glows appeared a year ago following the Krakatoa explosion, bears out the general experience of workers in other observatories, especially those who try to see stars near the sun in the day-time."

Whether this remarkable condition of the atmosphere can be reasonably supposed to have any relation to the unusual continued mild and calm weather of the present autumn, is an idea that readily suggests itself, though it may probably be but a mere coincidence. This and many other related questions are as yet unsolved, and the whole subject has not by any means lost its interest.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Oct. 20th to 30th.	Nov. 1st to 10th.	Nov. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	32.	25.	27.	28.
Max	75.	79.	77.	77.
Min. and Max	53.	52.	52.	52.
Range	43.	54.	50.	49.
TRI-DAILY OBSERVATIONS.				
7 a. m.	40.1	40.2	36.0	38.8
2 p. m.	62.0	65.6	59.0	62.2
9 p. m.	47.3	44.6	42.9	44.9
Mean	49.8	50.1	45.9	48.6
RELATIVE HUMIDITY.				
7 a. m.	.904	. .	. .	. .
2 p. m.	.488	. .	. .	. .
9 p. m.	.805	. .	. .	. .
Mean	.732	. .	. .	. .
PRESSURE AS OBSERVED.				
7 a. m.	29.108	29.185	29.148	29.164
2 p. m.	29.170	29.178	29.123	29.157
9 p. m.	29.157	29.173	29.133	28.154
Mean	29.233	29.179	29.135	29.182
MILES PER HOUR OF WIND.				
7 a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Total miles	2105	1774	1939	5818
CLOUDING BY TENTHS.				
7 a. m.	4.8	2.1	4.4	3.8
2 p. m.	5.2	2.0	5.1	4.1
9 p. m.	3.8	1.2	3.7	2,9
RAIN.				
Inches	3.2	.05	.43	.80

The month's report here given embraces the period of least rainfall yet observed in any month of this year. October during its last decade was very pleasant autumn weather, frosts occurring on the 22d, 25th and 31st. The first snow storm occurred November 18th, but melted nearly as fast as it fell, but up to the 20th no freezing happened at this place which did any damage to root crops.

ENGINEERING.

AMERICAN AND ENGLISH CITY RAPID TRANSIT.

While we have been talking and arguing about speedy means of intercommunication in large cities, a necessity of modern times (not because large cities have not before existed, but because in these days of telegraphs and telephones, of stenographers and typewriters, the rapid interchange of thought and word begets a longing for as rapid transit of matter and of man from point to point), and have given to our own cities and to the world the American surface street railroad or tramway, the slightly more rapid cable road, and the somewhat speedier stilted steam road, our conservative British brethren have quietly studied out the question of demand and supply, of outlay and profit, and have gone on to construct a work which furnishes to their metropolis what we have longed for but feared to undertake—speedy, safe and convenient intramural transit. And, what is more, they have done it without interfering with public property or violating private rights.

The Metropolitan Underground Railway, which traverses the heart of the most populous city of modern times, has been undertaken by capitalists who did not conceive it to be their first duty to seize upon lands which had been purchased by the public for a specific purpose and divert them to another purpose without compensation to the owners of abutting property. They seem to have had the pluck and the foresight to realize that a judicious expenditure to enable them to own the land they occupy, and to construct an enduring work, will prove more remunerative in the long run than a more fragile construction, with the risk, besides, of having to pay damages for encroachment on private rights.

The last completed section of this magnificent work, from the Mansion House to the Tower, a distance of about three-quarters of a mile, has been executed within the last twenty months, and runs "beneath residences, warehouses, and roadways, and in all the difficult labors of underpinning, propping and building there has not been a single accident." Enormous warehouses, containing iron safes and strong boxes, have been tunnelled under without disturbing their contents, and the statute of King William, which, with its pedestal weighs 179 tons, has been underpinned and rests on the arch of the tunnel. Large trees have been undermined and underpinned without removal or injury. The result is that there is a substantial roadway on which the heaviest trains can run at high speed, and passengers can go from point to point in London without creeping along at twelve miles an hour on a structure which sheds bolts and nuts and rivet-heads down on the heads of passers-by, and requires constant repairs, while the gas and smoke and noise offend the innocent dwellers alongside the line of travel.

We doubtless have engineers as capable to design, and builders as competent to execute such work as the Metropolitan Railway as any in the world, but we seem to need capitallists bold and far-seeing enough to appreciate the fact that what New York and other large cities need are permanent roads, fitted for real rapid transit, owning their right of way, and not interfering with public property or individual rights. Whether the structures should be elevated above or depressed beneath the surface of the ground is a matter of local adaptation and convenience, but the principles of absolute independence of ownership and freedom from complications, on the one hand, with structures owned by the public and maintained solely for their benefit, and on the other hand with rights and privileges acquired by private citizens, partly at public expense and guaranteed to them by the public.

The amount of city travel is proved by experience to grow in proportion to the facilities afforded for it. The construction of the elevated railroads in New York City has doubled the travel on the longitudinal routes in six years. The resources of the elevated and surface roads are now taxed to their utmost, and the necessity is pressing for more and quicker modes of transit.

It certainly seems as if a sensibly designed and honestly executed scheme ought to bring fair profits on legitimate expenses.—*Sanitary Engineer.*

GEOLOGY.

CORRESPONDENCE.

PLEASANT HILL, MO., November 21, 1884.

EDITOR REVIEW, DEAR SIR,—In the REVIEW for November Prof. J. D. Parker discusses the Burlington Gravel Beds. As I have not been to that place I cannot discuss them. But if Mr. Parker will refer to Vol. III No. 8 p. 460 of the REVIEW he may be interested in an article of mine on "Surface Deposits of Southwestern Missouri and Southeastern Kansas" lying south of the marked limit of "glacial drift." I suppose the Burlington gravel must be of similar age to like deposits along the Neosho to the south, which I have seen. Most of the gravel that I have seen from those beds I can refer to the age of the Upper Carboniferous or Coal Measures. That of Kansas is certainly all of that age, and the gravel deposits all overlie the coal measures.

The gravel on the "Flint Hills" is generally angular or sometimes locally worn; that on the Neosho, Fall River, Walnut, the Valley of the Pottawatomie and the Marais des Cygnes is evidently water worn and the beds generally lie above all known high-water.

Similar deposits exist near the Marais des Cygnes in Bates County, Mo., and

on some ground of a little higher elevation in Bates, Vernon and Jasper Counties, Mo. In Jasper County it may be found on high ground near Carterville and near Carthage.

Deposits of northern gravel (rounded granite, quartzite, etc.) I have found south of the Missouri River in only St. Louis and Saline Counties. But isolated boulders are found near the Missouri River at many places. Rounded boulders of cretaceous and upper carboniferous are often found in the drift of northwest Missouri.

The Ohio and the Missouri I regard as the southern limit of the great northern drift (glaciers). West of the State of Missouri the line trends to the northwest and north.

G. C. BROADHEAD.

PROCEEDINGS OF SOCIETIES.

KANSAS ACADEMY OF SCIENCE.

The first day's session of the Seventeenth Annual Meeting of the Kansas Academy of Science, was held at Lawrence on the 24th ult. The afternoon session was held at the parlors of the Eldridge house, and consisted first of a general business meeting, at which reports of committees were read and officers were elected, and secondly of a session for special business, at which action was taken in regard to the geological survey of the State and in reference to the publication of the proceedings. Reports on the condition of the museum and library were also read.

At the evening session in University Hall the president, Dr. R. J. Brown, of Leavenworth, delivered the following address upon the question :

"IS A GEOLOGICAL SURVEY OF THE STATE A NECESSITY?"

GENTLEMEN OF THE ACADEMY OF SCIENCE:—In accordance with the custom and rule of this academy, the president is required to deliver an address at each annual meeting, upon some subject pertaining to the work of the past year or on the advancement and progress of science in our midst. In response to this the work and labor the members of the academy will be presented to you, as they have come fully prepared with papers of great value and interest, covering al branches of science, with new discoveries and new developments in every department. I congratulate the members of the association upon the success of their efforts to advance the interests of the academy. Time, labor and money have been expended to bring together so much original investigation and research that will be appreciated by scientists everywhere and by the people of our State.

We shall devote the remainder of the evening to something we deem of vital importance to our State. That is a geological survey of Kansas. If we can convince you and through you the great mass of our citizens that there is a necessity that such a work should be made, and that the benefits derived from it will be one hundred times the cost attending the same, our labor in bringing this subject before you will not be without some good results. This Academy was organized for the advancement and promotion of scientific knowledge. In pursuit of it a great many facts in regard to the resources of the State have been made public which have proved of great value to the people of this commonwealth. Take for instance the weather reports by Professors Snow and Lovewell, which have been furnished to the public; the botany of the State by Prof. Carruth; the geological formations by the late Prof. Mudge; besides mineral deposits, insect life, etc., by other members of the academy.

We know little in regard to our mineral wealth. The digging of a well has developed coal, opened up lead mines, brought forth mineral waters, unearthed hidden treasures, etc. If the State should take hold of a geographical survey and prosecute it faithfully the public would find that Kansas possesses within her valuable resources, which now lie idle and unknown. What is there in a geological survey that the farmer, merchant and mechanic should lend his aid and influence in securing an appropriation for this purpose? He might say if coal was found in great abundance in his vicinity, it would reduce the price; if the rainfall could be regulated so they could get it when needed; if frost could come only in winter; if grasshoppers could be kept away; if all the various insects that prove so destructive to fruit and grain could be rendered harmless, a geological survey would be a good thing. We all agree to this, and believe a great deal may be accomplished in benefitting the public that they do not know of now, and much more to the development of the State.

A bill was introduced during the meeting of the last legislature asking for a small appropriation for a geological survey. A large number of the members thought it a good thing, but that the railroad bill should pass first. Others said it will cost too much, can't afford it; others asked what is the use of a geological survey? Another said a geological survey is to pay the expenses of collecting old bones and minerals that are found scattered over the prairies. These are some of the objections to a geological survey, showing that the purpose and object are not generally known. Some think it is merely topographical survey, that refers to the surface entirely and has little or nothing to do wtth anything found below the surface. From the various opinions that people have in regard to it, we believe a great many do not understand what a geological survey is, or the benefits to be derived from it. If properly understood we believe there would be no difficulty in securing an appropriation for the work.

We shall endeavor briefly to state what a geological survey is, and some of the advantages of it. It comprises exploring everything on and below the surface, where the most valuable part of the earth may be found, boring and digging into the crust of the earth to any depth that may be necessary to develop everything that

may be of value. Should coal be found, all information in regard to the area, depth, thickness of vein, character and value for heating purposes and probable cost of mining the same would be fully noted.

Location of lead and other minerals, the districts in which they may be found, their depth aud all other information that may prove of value.

Clays of various kinds for the manufacturing of pottery, tiling, brick, etc.

Chalk, limestone, sandstone, gypsum and other materials used for building purposes. Zinc, bismuth, arsenic, strontia and other minerals used in the arts; the cost of mining the same, and their commercial value. Also the botany of the State, showing the distribution of the timber and vegetable growth indigenous to the State, water power on all the rivers and streams and the fall from various points, with such information as will enable every one to understand their availability as water-power for manufacturing purposes. An analysis of all the mineral waters, gas wells, their extent and value, and the practicability of using the gas for fuel and lighting purposes. An examination of the character of the soil from all the counties of the State with an analysis of the same, indicating the soil suitable for the growth of various agricultural productions, in such a way as to be of practical value to the farmer. Rainfall and temperature should be accurately obtained. Considerable attention would be given to the eradication, and means of destruction of insects that are injurious to fruit and fruit trees and prey on the products of the soil: these and a great many other things will be developed that will prove a benefit to our people and of immense value to the State.

County maps should be made, giving a full history of the resources of the county, describing accurately the depth, location, character of all coal deposits, clays, building stone, soils, water-power and all information that would be of value to the counties, and cost of utilizing the same. Publishing maps for the counties, supplying the people with the reports of the survey and disseminating information during the progress of the work. All these come within the range of a geological survey and properly belong to it. To do this work an expenditure of money, not a great deal less than $100,000 during the next ten years will be required to cover the entire expenses of it. In return for this outlay we cannot estimate in dollars and cents the value to the State. We have the evidence of the most prosperous States where surveys have been made, that it has been of untold value to them. It is a work of great importance, benefitting all the citizens alike, bringing prosperity, building up and developing the State and publishing the advantages that we possess now hidden from view; saving thousands of dollars to people who, without any knowledge of what we have, embark in enterprises that may or may not be a success. The useless waste of money would be prevented. With a geological survey, almost a certainty in regard to success would be secured.

If you want to mine for coal, you will know at what depth and in what quality it can be fonnd. If for lead, zinc and other metals, reference to the geological

survey will tell you; all question concerning the existence of mineral waters, building materials, etc., will be fully answered.

At the present time there is considerable interest manifested in regard to the sinking of artesian wells in the western part of the State, which cannot be done until a geological survey has been made, and to delay now would be hindering the growth and development of our State. We believe it would be for our best interests. In order to get the experience of other States that have had geological surveys, I some time ago mailed to the Secretaries of each one of the States in the Union a number of questions in regard to the matter, and have received replies from twenty eight States.

The doctor then read the replies received from these States in regular order, beginning with Maine in the East, and closing with Colorado in the West. All bore testimony to the great importance and value of such work wherever it had been done.

Third day's session opened with the reading of the "Reports of the Commission on Chemistry upon the Year's Progress," as follows:

"In Organic and Physiological Chemistry," Prof. E. H. S. Bailey, Lawrence.

On "Technical and Industrial Chemisty," Prof. H. E. Sadler, Emporia.

On "Agricultural and Analytical Chemistry," J. T. Willard, Manhattan.

"Statistics of Color-Blindness in the University," Prof. E. L. Nichols, Lawrence.

On the "Analysis of the Water of the Fort Scott Artesian Well," E. H. S. Bailey and E. W. Walter.

"Some Special Tests in Regard to the Delicacy of the Sense of Smell," E. H. S. Bailey and L. M. Powell.

The afternoon session convened at 2 o'clock, and papers were presented in the following order:

On "Some minerals of Kansas," E. H. S. Bailey.

On the "Supersaturation of Vapors," Prof. E. L. Nichols.

On a "New Method of Studying Absorption Spectra," W. S. Franklin.

"November Meteors," R. S. Short.

The following valuable paper was then read by its author:

"IS THE RAINFALL OF KANSAS INCREASING?"

PROF. F. H. SNOW.

In the present paper attention is called to the fact of an increase of rainfall rather than to the various theories which have been advanced to explain such increase, or to show that there ought to be an increase.

Geologists, physicists and astronomers are harmonious in accepting it as an established fact that the earth in common with all other worlds in the universe is

slowly passing through a series of changes from an original nebular mass of intensely high temperature to an entirely solid mass of low temperature. The sun and the larger planets of our system illustrate the early stages in this series of changes. The earth is in an intermediate condition between the two extremes, and the earth's moon represents the extreme of entire solidity, in which the waters and the atmosphere which once covered and surrounded its surface have been absorbed within its mass, and a very low temperature continually and everywhere prevails. There can be no doubt that the earth is very gradually approaching the moon's condition, and that some time in the far distant future, how many millions of years hence no man can determine, its atmosphere and surface waters will entirely disappear, and a low temperature prevail, even in its tropical regions far exceeding the cold of the coldest Arctic winters in the present age. There can be no doubt, therefore, that, considered with reference to long periods of time, the rainfall of the earth is diminishing. If prehistoric man, 10,000 years ago, had kept scientific records of the rainfall of his time, and it were possible to compare these records with those of the present day, it would be found that a considerble reduction of the average annual precipitation has been made in the period named. Even a thousand years might show a perceptible decrease. But in so short a period as the lifetime of a single generation of men, or even in an entire century, the average annual rainfall of the entire globe has probably been reduced to so slight an extent as to be expressed by a very few hundredths of an inch.

Yet, although the entire movement is in the direction of a reduction of the rainfall, there are without doubt, local oscillations in consequence of man's influence upon nature, which in some cases result in a more rapid decrease than would otherwise be accomplished by the unaided forces of nature, and in other cases within limited areas secure an actual increase in the rainfall. I believe the State of Kansas furnishes an apt illustration of a change of the latter sort. Here the circumstances have been extremely favorable to such a change. Thirty years ago the Territory of Kansas was not occupied by the white man, and if we except a few acres cultivated by the Delaware Indians, no portion of her soil had been turned up by the plough. Her entire area was included within the vast and almost unknown region of the "Treeless Plains" and the "Great American Desert." During that brief intervening period, more than 1,000,000 people, chiefly of the agricultural class, have taken possession of her domain and have already brought her to the very front rank of the States of the Union in the extent and value of her agricultural products.

History affords no other instances of the permanent occupation of so extensive an area previously unoccupied by man by so large an agricultural population in so short a space of time. Here certainly, if human agency could anywhere affect climate, would such an effect be produced. Here, assuredly, if settlement ever increases rainfall, will such increase be most marked and most unmistakable. That such increase has actually taken place, I believe to be established beyound a doubt. It is a circumstance peculiarly favorable to the determi-

nation of the point in question, that although the general settlement of Kansas by cultivators of the soil is of such recent date, reliable observations upon the rainfall had been made at the military posts upon her eastern borders for a sufficient period to make possible a satisfactory comparison between the rainfall before settlement and after settlement. The records at Fort Leavenworth cover the longest period and enable us to compare the nineteen years immediately preceding the occupation of Kansas by white settlers, with the nineteen years immediately following such occupation. During the first period the average rainfall was 30.96 inches; during the second period it was 36.21 inches, giving an average increase of 5.21 inches per annum. Here we have an increase of nearly 25 per cent in the rainfall, under such conditions as to necessitate the inference that such increase is chiefly, if not entirely, produced by causes connected with the introduction upon a large scale of an agricultural population into a previously uncultivated territory. The Fort Leavenworth records cover so long a period of time (nearly forty years), that the increased average of the second half of the period cannot be attributed to a mere "accidental variation." In the issue of *Science* for April 18, 1884, it is stated that "the supposed increased rainfall in the dry region beyond the Mississippi is not borne out by the returns of the Signal Service." But the records of the Signal Service, upon which this statement was based, include a period of only twelve years of observation, from 1871 to 1882, which is undoubtedly too short a period for either establishing or disproving the fact of a "secular" variation. We have also called attention to the fact that causes which have a tendency to secure an increased rainfall, have here been put into operation upon a grander scale than in any other portion of the dry region west of the Mississippi.

But the fact of an increased Kansas rainfall does not rest entirely upon the Fort Leavenworth observations. There are other stations in Kansas whose records cover a much longer period than that of the longest established regular station of the Signal Service. There are the twenty years' records of the United States military post at Ft. Riley, the twenty-four years' records of the State Agricultural College at Manhattan and the seventeen years' records of the State University at Lawrence. If these several periods of observation be divided into two equal parts, in each case it is found that the average rainfall of the second half is notably greater than that of the first half. At Ft. Riley the increase amounts to 3.05 inches per anuum, and at Manhattan to 5.61 inches per annum and at Lawrence at 3.06 inches. Expressed in per cent the rainfall of these three stations has increased in the second half of each period of observation at Ft. Riley, 13 per cent; at Manhattan, 20 per cent, and at Lawrence over 9 per cent. If increased rainfall could be shown by the records of a single station only, or if the several stations, with sufficiently long periods of observation, exhibited discordant results, some indicating a decrease, while others indicated an increase; or, if even a single station indicated a diminished rainfall, the fact of a general increase would lack satisfactory demonstration. But the entire agreement of the four stations, whose records have value in a discussion of this question, seems to es-

tablish beyond doubt the fact of an increased rainfall in the eastern half of Kansas.

There can be no reasonable doubt that the general settlement of the western portion of Kansas will have a similar effect upon its rainfall, but it is not reasonable to expect that Western Kansas will ever boast of a rainfall equal to that of Eastern Kansas. So long as the eastern half of the State remains to the east of the meridian forming the western boundary of the Gulf of Mexico, the south winds will cause it to receive much larger supplies of vapor for condensation into rain than will be received by the western half of the State, which lies beyond the immediate track of the vapor laden winds. It must be remembered that climatic changes are exceedingly gradual and a rain deficiency or excess for a single year, or for two or three years in succession, must not be considered as invalidating the law of general averages. Neither should the fact that the rainfall upon the whole is increasing induce settlers to break land in the western third of Kansas with the expectation of successfully raising the same crops as in Eastern Kansas. Such settlers will surely be disappointed. It is even doubtful if paying crops of any kind can ever be continuously produced in that region. With an average before settlement of about 15 inches per annum, the same percentage of increase as has been made in thirty years would reach an amount of less than 18 inches per annum,—a quantity entirely inadequate to maintain successful agriculture.

Following this paper by Prof. Snow, the papers as given below were read and discussed until a late hour in the afternoon:

"Notes on the Geology of the Spanish Peaks," Joseph Savage, Lawrence.

"Practical Studies in Geology, C. H. Sternberg, Lawrence.

"Sources of the Kansas River Sands," Joseph Savage.

"The Last Submergence and Emergence of Southeastern Kansas from the Carboniferous Seas," E. P. West, Wyandotte.

"Notes on the Geology of Douglas County, Kansas," Joseph Savage.

"The Christening of Amethyst Mountain in Yellowstone Park," Joseph Savage.

"In the Dakota," Robert Hay, Junction City.

Report of the Commission on Mineralogy on the catalogue of Kansas Minerals, Prof. G. H. Failyer, Chairman, Manhattan.

"Notes on a Bison from the Tertiary," Robert Hay.

The following papers were read at the regular sessions.

"Additions for 1884 to the Catalogue of Kansas Coleoptera," Warren Knaus, Salina.

"On the Preparatory Stages of *Hyperchiria Zephyria* Grote," Prof. F. H. Snow, Lawrence.

"Contributions to a Catalogue of Kansas Hemiptera," Prof. E. A. Popenoe, Manhattan.

"On Some Salt Marsh Coleoptera," Warren Knaus.

"On Some Rare Coleoptera from Southern New Mexico," Prof. F. H. Snow.

"List of Kansas Orthoptera collected in 1884," Prof. E. A. Popenoe.

"Report of the Commission on Ichthyology," Prof. I. D. Graham, Chairman, Manhattan.

"Some Kansas Food Fishes," Prof. I. D. Graham.

Additional papers were promised by Prof. D. L. Jordan and others.

"Contributions to a list of Kansas Mollusca," Prof. E. A. Popenoe.

"The Historical Indian," Frank Kizer, Emporia.

"Partial List of Parasitic Fungi of Kansas," Prof. W. A. Kellerman, Manhattan.

"How to Botanize," E. N. Plank, Independence.

"On Generic Characters in Botany, B. B. Smyth, Topeka.

"Vegetation in Western Kansas," Rev. J. D. Parker, U. S. A., Ft. Hays.

"On a Method of Arranging a Herbarium for Popular Inspection," Rev. J. H. Carruth, Lawrence.

"Note on the Coloration of Fluorite at Different Temperatures," Prof. G. H. Failyer, Manhattan.

"Some Kansas Mineral Waters," Prof. G. H. Failyer.

"Fossilized Buffalo Jaws," Prof. Robert Hay, Junction City.

"Effects of Parasitic Fungi upon the amount of Sugar in Stalk and effects of Silo Treatment upon the amount of Sugar in Sorghum," E. B. Cowgill, Sterling

"Notes Upon Gulls, A. P. Fellows, Lawrence.

"November Meteors," Mr. Short, Lawrence.

The officers for the coming year are as follows: President—Dr. R. J. Brown, of Leavenworth; Vice-Presidents—Prof. E. L. Nichols, of Lawrence, and Prof. G. H. Failyer, of Manhattan; Treasurer—A. H. Thompson, of Topeka; Secretary—Prof. E. A. Popenoe, of Manhattan; Curators—O. H. St. John J. T. Lovewell, G. S. Chase, J. H. Carruth, and F. W. Cragin; Librarian—F. W. Cragin.

On Tuesday evening a popular lecture was delivered by Prof. J. D. Parker, U. S. A., upon "Circular Storms," which was very well received by a fair audience.

The discussions that followed the reading of many of these reports and papers were not the least interesting part of the proceedings, and testified at the same time to their value.

The hospitality of the Lawrence members was unbounded, and many of the students of the University and residents in the city participated in the sessions and lectures.

Manhattan was selected as the place for the next annual meeting.

All friends of science will be glad to learn that the Kansas Academy is steadily growing in influence and usefulness, and is likely to become an important factor in the future development of this great State.

MEDICINE AND HYGIENE.

COCAINE AS A LOCAL ANÆSTHETIC.

FLAVEL B. TIFFANY, M. D.

Cocaine, a local anæsthetic which is now engaging the attention of the medical profession throughout Europe and America, is an alkaloid of the *erythroxylon coca*. For nearly thirty years the natives of Peru, the country in which the shrub is indigenous, have used the leaves of the plant when making long journeys, as an exhilarant and a promoter of a greater power of endurance and of respiration. Scientific knowledge of the power of this drug dates only one year back. The Germans first employed it in the examination and treatment of the throat. To Dr. Kohler, a student of Vienna, belongs the honor of discovering this boon in ophthalmic surgery. He communicated this discovery to Dr. Brettaner, of Trieste, who demonstrated its magic power before the last ophthalmological congress of Heidelberg.

It was first introduced into the United States, October 11, 1884, by our distinguished confrere H. D. Noyes, who witnessed the experiments at Heidelberg. Since that time, a little more than two months, all the prominent members of the medical profession here have been on the *qui vive* to test the power of this drug to the utmost. Drs. Agnew, Knapp, and others, have reported of several cases of major and minor operations upon the eye, in which its efficacy as a local anæsthetic was thoroughly proven. Dr. Wm. Olive Moore and more recently many others, have used it with good results in inflammations and ulcerations of the cornea and conjunctiva (front part of the eye-ball). Last Tuesday, November 18th, I used a two per cent solution of the hydro-chloride of cocaine upon a man sixty-seven years of age, for the extraction of a cataract. I made a preliminary application in the morning that I might observe its action. In about three minutes after an instillation of three drops there was complete anæsthesia of the anterior portion of the eye-ball, so that I was able to pass my finger-nail over the front of the eye without the least discomfort to the patient. The anæsthesia passed off in about thirty minutes, leaving no irritation of the eye. In the afternoon of the same day, at the Sisters' Hospital, I used the same per cent solution, increasing the number of drops, and in about three minutes the eye was completely benumbed.

The patient, passing his finger over his eye, said that there was no feeling there: "Doctor you could gouge my eye out now, if you wanted to, and I should not feel it." I then made the operation without the least discomfort to the patient and the results of the operation have been perfect. On Monday the 24th, I again employed it in the same operation on a man aged seventy-nine years

with equally happy results. In both cases there was entire absence of pain in the eye, or swelling or inflammation of the lids, complications not unfrequently arising from nausea and emesis produced by ether or chloroform. On the day following the first operation, November 18th, wishing to test the drug as to its efficacy as a general anæsthetic as well as a local, Dr. E. Von Quast, of this city, experimented with me upon a Guinea-pig with the following results. At 11 A. M. we injected hypodermically one-half minim of a two per cent solution: in three minutes there was a slight dilatation of the pupils, accompanied by a general muscular exhilaration; five minutes later we injected another half minim with no increased effect, then we used three minims with some diminution of sensibiliity. In twenty minutes from the first injection I injected five minims more, which occasioned complete loss of sensibility.

We could now now pass the hypodermic needle through the foot, ears, tongue, or fold of the skin without eliciting the slightest sign of pain or discomfort, whereas before the last injection the pig would squeal piteously whenever the needle entered his skin.

During the entire experiment there was apparently no loss of consciousness, nor of power of co-ordination, and up to now the pig is none the worse for the experiment. We may at least gather from this that cocaine may be a boon to animals in vivisection.

November 20th I used the solution hypodermically upon myself, some patients and several physicians, with the following general results: With from five to ten minims of a two per cent solution, injected in the forearm, there was almost immediately produced a sensation as of ants running over the skin, a slight numbness of the arm, and complete anæsthesia within a space of one inch from the point of injection. There was some slight exhilaration, a freer respiration, and slightly flushed cheeks. I have, within the last few days employed this agent in subduing photophobia (dread of light) and find it, so far, beneficial. I employed it also in a case of ezcema of the external ear, where there was intolerable itching, with good effect.

It acts like magic in subduring the pain of acute inflammation of the middle ear. It is also useful in reducing the sensibility of the lining membrane of the nose, when necessary to treat the ear through this channel.

Cocaine has also been employed in the treatment of hæmorrhoids, in removing polypi of the nose and ear, small tumors of the skin and in the treatment of diseased mucous surfaces in general with happy results.

Kansas City, December 1, 1884.

BOOK NOTICES.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION FOR 1882, Spencer F. Baird, Secretary. 8vo., pp. 855. Government Printing Office, 1884.

This report, though, as usual with all government documents, nearly two years behindhand in being published, is really an exceedingly valuable work. It comprises the Proceedings of the Board of Regents for the January meeting, 1883, Report of the Executive Committee, the Annual Report of the Secretary, and the General Appendix; which last presents a record of recent progress in the principal departments of science and special memoirs, original and selected, of interest to collaborators and correspondents of lhe institution, teachers and others engaged in the promotion of knowledge. The various departments of science have been ably presented by Prof. Baird himself, Prof. E. S. Holden, Prof. T. Sterry Hunt, Lieut. F. M. Green, Prof. Cleveland Abbe, Prof. Geo. F. Barker, Prof. H. Carrington Bolton, Prof. E. S. Dana, Prof. W. G. Farlow, Prof. Theodore Gill and Prof. O. T. Mason. All of these gentlemen are experts in their several lines of study, and the reader need look no further for a complete statement of the progress made in each department during the year 1882.

If these reports could be published with reasonable promptness they would be of the greatest value to students and others; as it is, they are usually laid upon library shelves as mere works of reference.

PUBLICATIONS OF THE WASHBURN OBSERVATORY OF THE UNIVERSITY OF WISCONSIN, Volume II, Octavo, pp. 400. Democrat Printing Co., Madison, Wisconsin, 1884.

This observatory, founded by the late Hon. C. C. Washburn, is under the directorship of Prof. E. S. Holden, of the U. S. Naval Observatory. Its equipment of instruments is very complete and has been largely increased since the publication of the first volume, notably by the purchase of a Repsold Meridian Circle at a cost of over four thousand dollars, to a description of which some fifty pages are devoted. Also by the purchase of a Sidereal clock, a Howard mean time clock, a six-inch equatorial telescope, and a number of minor instruments. Besides these, the library has received quite an accession, and now consists of about 1,000 volumes and 600 pamphlets.

The work of the Observatory has been extensive and various, both astronomical and meteorological, the latter department having been added in August 1883, when the instruments, etc., of the signal service station at Madison were transferred to it. Few observatories in the country are superior to the Washburn either in the number and value of its astronomical instruments or the amount and quality of the work done.

First Principles of Natural Philosophy: By Elroy M. Avery, Ph. D. 12mo., pp. 402. Sheldon & Co., New York and Chicago, 1884. For sale by M. H. Dickinson, $1.00.

Doctor Avery's Physical Science books have a well deserved reputation for simplicity, clearness and thoroughness wherever they have been used. This little work, the first of the series, is intended for the use of schools in which the course is not full enough to warrant the use of the Author's "Elements of Natural Philosophy," a larger and more comprehensive treatise. The arrangement of topics, the method of their handling and the illustrations are all excellent, and in addition to this the latest developments of science, such as the introduction and use of electrical units, have been freely utilized. The work is divided into nine chapters in which are discussed respectively, matter, motion and force, simple machines, liquids, pneumatics, electricity and magnetism, sound, heat, light. The concluding chapter takes up the subject of energy. The index is copious and carefully arranged.

The younger students will find this an excellent text book and the recapitulatory exercises especially valuable.

The Home Physician: By Luther M. Gilbert, M. D. 12mo. pp. 131. G P. Putnams' Sons, New York, 1884. For sale by M. H. Dickinson, $1.00

This little work is intended for the use of travellers and families at a distance from physicians, and contains much valuable advice and instruction for such persons. It is divided into an introduction in which, among other things, a list of household medicines is given, a chapter on the Uses of medicine, one upon general Observations of Symptoms and Remedies, a third giving descriptions of Disease and Treatment, a fourth upon Surgery, and a final one upon Poisons.

Doctor Gilbert is attending physician at the Connecticut General Hospital at New Haven, and also President of the Medical Board of the same. His experience has been large and his suggestions are based upon an extensive practice. If any fault is to be found with his advice as to treatment, it is that in some of the most serious and fatal diseases, such as croup, and diphtheria, sufficient stress is not given to prompt and vigorous measures. In other respects the advice given is good and rational. For the purposes for which it was written it will be found very useful.

Bulletin of the Museum of the State University of Missouri. Niagara Fossils: By J. W. Spencer, B. A. Sc., etc; Professor of Geology in the University of the State of Missouri. Vol. 1. No. 1. Printed for the Museum, May, 1884.

This bulletin is the first of a series proposed to be issued by the officers of the Museum of the State of Missouri, giving the result of scientific investigation from time to time in this form. This paper includes (Part I) a Monograph of

forty-one species of *Graptolitidæ* (of which thirty are new); (Part II) a Monograph of *Stromatoporidæ*; and (Part III) a description of fifteen other new species of Niagara fossils. The *Graptolites* are plant-like animal forms of much interest to palæontologists on account of their great antiquity and their having long occupied the border land between plants and animals, but the idea of their plant-origin has been abandoned and they are now placed with the Polyps. The forty-one species of fossil Graptolites described in this paper are principally from the Upper Silurian at Hamilton, Ontario. In the introduction the student will find much valuable information in a condensed form in regard to the literature of the history of the study of the Graptolite family, their geological distribution, zoölogical affinity, structure, etc.

After the Graptolites the most interesting fossils of the Niagara formation are the Stromatoporidæ. In Part II. a number of species of this family are described, four of them being new; preceded by a short account of the genus Stromatopora. In Part III, fifteen other new and interesting fossils from the same formation at Hamilton, Ont., are described. Nine plates of about eighty-five good figures, add much to the value of the Bulletin, and will assist the student in identifying the fossils described.

It is to be hoped the officers of the Museum will soon work up the accumulations of the various Geological Surveys of the State of Missouri, which have long remained buried in the University and are now at their disposal. The results of their investigations in this mass of material, given in the form of this Bulletin, will be of great interest and value to scientists, and especially the geologists of this state. L.

PUBLIC RELIEF AND PRIVATE CHARITY: By Josephine Shaw Lowell. 12mo. pp. 111. G. P. Putnams' Sons, N. Y. 1884. For sale by M. H. Dickinson. Paper 40c., cloth $1.25.

This is Number XIII of Putnam's "Questions of the Day" series, which so much attentton by reason of their practical discussions of every day political and social topics. Its author has been and now is identified with the public charities of New York, and, as this work shows, is abundantly capable of discussing the subject. The first chapter gives her personal views on the subject of Public Out-door Relief, the second is a compilation of the various Practices in this direction in England, the third the Practices in Europe and the United States. To these follow the author's conclusions. The second part is devoted to Private Charity, and in it are discussed charitable institutions, principles and rules, methods in city and county, with practical suggestions based upon the author's experience. It is a work of great worth, and we recommend it to the Provident Associations and other public charity societies in the West as a practical guide, or at least, a competent helper in their perplexing and burdensome labors.

A Young Girl's Wooing: By E. P. Roe. 12mo. pp. 482. Dodd, Meade & Co., N. Y., 1884. For sale by M. H. Dickinson, $1.50.

We do not know how many novels Rev. Mr. Roe has written, but, judging from the large sales of all of them, he has not yet "outlived his usefulness" nor his popularity. Whatever we may say of such books in general, it is proper to say that the style of the author is attractive and the moral tone of his works irreproachable.

The volume under consideration is no exception in excellence to those preceding it, and is interesting as a story and well written as a literary production.

The Religions of the Ancient World: By Professor George Rawlinson. Sent to any address for 30 cents. J. Fitzgerald, Publisher, 20 Lafayette Place, New York. For sale by M. H. Dickinson.

The study of the religious systems of antiquity, of the forms assumed by religious ideas in their development among the Egyptians, Babylonians, Chaldeans, Greeks, Romans, and other ancient peoples; their mythologies, their curirites and ceremonies, their beliefs as to a future state, etc., is one of the most important and interesting branches of historical research. No more competent guide in this fascinating study could be found than Mr. Rawlinson, the well-known author and Camden Professor of Ancient History in the University of Oxford, and no edition can better meet the wants of the masses than this.

OTHER PUBLICATIONS RECEIVED.

Bulletin of Museum of State University of Missouri: Niagara Fossils, by J. W. Spencer, B. A. Sc. in 3 parts, Vol. 1, No. 1., St. Louis, Mo., 1884. Papers of Archæological Institute of America, II: Report of Archœological Tour in Mexico, in 1881, by A. F. Bandelier; published by Cupples, Upham & Co., Boston, Mass. Instructions to Custodians of Public Institutions under Treasury Department, Government Printing Office. Catalogue of Flora of Minnesota, including its Phœnogamous and Vascular Cryptogamous Plants, by Warren Upham, Part IV of Annual Report of Progress of 1883, Minneapolis, Minn. Johns Hopkins University Studies—Herbert Adams, Editor. Second Series XI, Rudimentary Society Among Boys, John Johnson, Jr., Baltimore, Md. Report of Kansas State Board of Agriculture, for month ending Sept. 30, 1884, containing Topographical Description of State, Population, etc., Wm. Simms, Sec'y, Topeka, Kansas. The Health Miscellany, Fowler & Wells, Publishers, New York, 25cts. Address of Commander in Chief, Presented at National Encampment of G. A. R., Minneapolis, July, 1884, Philadelphia, Penn. Department of Agriculture—Chemical Division No. 3. The Northern Sugar Industry, during 1883, by H. W. Wiley, Government Printing Office. Department of Agriculture, No. 4, an Investigation of Composition of American Wheat and Corn, by Clifford Richard-

son, Government Printing Office. Popular Fallacies regarding Precious Metal Ore Deposits, by Albert Williams, Jr. Questions of the Day, XVI: The True Issue, by E. J. Donnell, G. P. Putnams' Sons, N. Y. 1884. Emblematic Mounds, reprinted from American Antiquarian, by Stephen D. Peet. Choice Literature Monthly Vol. 4, No. 21, $1.00 a year, John B. Alden, Publisher, N. Y. The Book Record, October, 1884, Vol. 1, No. 4, J. B. Alden, Publisher, N. Y., 25 cents a year.

The Monthly Weather Service, September, 1884, under direction of Gen'l W. B. Hazen, Thomas W. Woodruff, Editor, Signal Office, Washington, D. C. 1884. *Blackwood's Edinburg Magazine*, No. DCCCXXXVIII, Philadelphia, October, 1884, Leonard Scott Publishing Co., $3.00 a year, each No. 30 cents.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

PREVENTING THE AERATION OF LIQUIDS.—This invention relates to an apparatus for preventing the aeration of liquids in the process of withdrawing them from kegs or barrels, and it consists of a metallic tube formed with joints at suitable points and having at one end a tapering bung-piece within which a correspondingly tapered plug fixed upon a smaller induction tube, is removably secured.

The induction-tube has fixed to one end an expansible rubber bag or similar instrument. Much inconvenience and loss has heretofore attended the operation of drawing fermented liquids, for upon a quantity of the liquid being withdrawn from the cask the atmosphere enters and contaminates the whole.

In operation the induction-tube being attached to the tapered plug and to the inflatible vessel, the tubular bung-piece which is secured to the main tube is affixed to a barrel or cask of liquid, then the rubber bag is folded into a sufficiently small package, and by means of the inflexible induction-tube, it is inserted into the top of the main tube and forced therefrom to the interior of the cask, where it is inflated correspondingly as the said liquid is withdrawn.

Meanwhile the tapered plug has been forced to a tight joint within the tapering bung-piece. By attaching a funnel to the upper end of the induction-tube or by a similar arrangement, ice water may be used as the inflating fluid.

After all of the liquid has been withdrawn from a barrel or keg and it is not desired to apply the apparatus immediately to another, the main tube, together with the attached bung-piece and the induction-tube therein contained are first sufficiently loosened in the bung and then carefully withdrawn until the flexible

vessel (which obviously becomes disinflated by the operation) is clear of the bung-hole, after which it is then, by means of the induction-tube, drawn within the main tube, where, as before mentioned, it will be secure from the ravages of insects and vermin.

The inventor is Mr. J. H. Partridge, of Kansas City.

STOP-VALVE FOR RADIATORS, ETC.—This improvement consists in providing the valve-casing with a removable packing-seat in addition to the main valve-seat and further, with a continuous spindle that is devoid of a screw, and in lieu thereof is provided with a spiral-sping and a locking-lug which operates within a suitable longitudinal opening through the spindle casing.

The object being to construct a stop-valve principally for use upon steam-radiators, that will be quick in action, easy of operation and of simple construction and repair.

A suitable operating handle is attached to a plain valve stem operating within the stem-casing, which latter is provided with a longitudinal slot within which the locking-lug is adapted to operate and, by reason of an annular cam-shaped extension thereof in which the said lug adapted to be slightly rotated, the valve may be securely locked in a closed position.

The connections are threaded in the usual manner, and when it is desired to open the valve, the stem is slightly rotated, thereby releasing the locking-lug and bringing into action the spiral spring which instantly throws the valve open until its packing-side comes into contact with the seat upon the upper end of the thimble.

The thimble is provided with an annular flange, and is threaded upon each side for the purpose of forming a joint between the base of the spindle-casing and the valve-casing.

A number of inclined notches are placed along the sides of the locking-slot, for the purpose of holding the valve at any intermediate point of opening.

The inventor of this improvement is Mr. C. E. McClellan, of Kansas City.

GRASSES OF THE GREAT PLAINS.

Dr. George Vasey, botanist of the department of Agriculture, has returned having spent a month in the arid region of the west, chiefly in northern New Mexico, Colorado, and western Kansas and Nebraska, where he has been engaged in collecting specimens of the indigenous grasses of the country for the New Orleans exhibition, and making observations on the distribution of the different varieties, especially those which constitute the staple of the great pastures of the plains. Of fifty varieties obtained, all but a dozen or so were found in elevated situations on the mountain sides, where there is more moisture than on the plains; but it is among the dozen varieties found on the lower levels that the great herds of the pastoral region find their food, and of these the two varieties

known as buffalo grass and gramma grass, are beyond comparison the most important. These two, with the "blue grass," which ranks next in order, though far below them, constitute from seventy to ninety per cent of the pasturage of the arid region. The "blue grass" just mentioned—which must not be confounded with the cultivated grass of the same name—is found chiefly in low and comparatively moist spots, where it sometimes grows quite rank, attaining a height of three feet and making a good hay or acceptable winter pasturage. Cattle, however, will not eat it while the more nutritious buffalo aad gramma grass are to be had. Of these latter, Dr. Vasey found that the gramma grass (which in the northern territories is sometimes erroneously included under the term buffalo grass) predominates near the margins of the little streams and for some distance away from them, while the buffalo grass is the more abundant along the ridges. In the smaller mountain valleys gramma, as a rule, predominates.

Dr. Vasey estimates the number of cattle that can be pastured on a square mile within the arid region at from thirty to fifty head. He thinks that the produce of some of the wild grasses might possibly be increased by cultivation, and thinks it desirable that experiments should be made in that direction, and in general with a view to ascertaining the capabilities of the arid lands.

Alluding to the prevailing western opinion that the amount of rainfall increases with the settlement of the country and the breaking of the soil by the plows, he said that within the past three years there had undoubtedly been a considerable and successful advance of cultivation over lands formerly regarded as arid, but whether the rainfalls would permanently prove sufficient for agriculture remained to be seen. He noticed, however, that many ten-acre tracts of timber planted within the limits of the arid region under the timber culture act, appeared to be doing well, though in some cases he saw tracts where the trees, either from neglect, lack of moisture, or other cause, were dying out.

The boundary between the arid region and the country where the rainfall is sufficient for agriculture has commonly been placed at the 100th meridian. Dr. Vasey appeared to think that it might possibly be placed as far west as the 105th meridian, though the line is an irregular one, being further west in northern than in southern latitudes, and considerably further in the valleys near the longer rivers than in the more elevated regions lying between these streams.—*National Republican.*

THE STATE OF IOWA ONE HUNDRED AND SIXTY YEARS AGO.

The State of Iowa was delineated upon an old globe one hundred and sixty years ago. This globe is over seven feet in diameter and was made of wood, by a Capuchin monk, Father Legrand, in 1720, and is to-day preserved in the public library of Dijou, the French ancestral home of Father Laurent. On the proper place on its huge surface is marked the then known geography of what is now the State of Iowa and adjacent territory, and as elsewhere appears in the report

of the Academy of Science meeting, transcripts of this part of the globe (relating to Iowa) have been carefully made by M. Guignard, librarian of Dijou, and transmitted to the Academy.

What was known of Iowa and what was Iowa 160 years ago? We find the great river flowing by her eastern border and then known as the "Missisipi." Lake "Pepin" is located near St. Paul and is an immense widening of the river, which from this point north breaks into many streams.

The River des Moingona is easily recognizable from its name and course as the Des Moines, and is quite accurately traced, but widens into an immense lake near the Minnesota line, and at a point quite above is marked the spot inscribed, "To this point came the Baron Lahontan." It is probable that the Baron got mixed up in traveling over those marshy prairies, for though he evidently struck Lake Obokoji and Spirit Lake, he evidently got over on the Missouri. This river is down, but it runs parallel with the Moingona or Des Moines, up into Iowa and comes to a sudden end. Between these rivers was the apparent missionary ground of the Jesuit Fathers, for this country is thickly lined with the names of Indian tribes, while north of the Des Moines we find few Indian settlements.

Of the Indians, the Panis appear the most numerous. Others are the Esanapes, Panibousas, Paoutaouas, Aiaouez, Mahas, Tintons, Osages, Apanas, Panisassas, Cansas, and the Illinois, the latter being put on the west bank of the Mississippi, near St. Louis.

The only bluffs marked on the great river are located near Muscatine and below in Illinois.

There is a river flowing from a Lake Panis in Missouri eastwardly, which is named "Meschasepi," evidently a corruption of or the original of Mississippi.

The Ouabache (Wabash) empties into the Mississippi where the Ohio joins it, and the fathers evidently supposed the two rivers were one and the same.

Fort St. Louis is marked on the Illinois River, about 100 miles from its mouth.

Salt Springs are located very near the celebrated Hot Springs of Arkansas, and it is probable that the famous Arkansas baths had been tried by these early missionaries, let us hope with great relief to those pioneer fathers who were traversing the malarial swamps of the West 200 years ago in the service of their Master.

Many other singular features appear in these *extraits* from the old globe. They are the earliest map of Iowa extant, so far as known, and will be studied with deep interest by students of history and geography. They settle the question of the origin of the name of Iowa's capital and river, which but for the elegance of the present combination should be changed from Des Moines to Moingona. The present name has no meaning; the other name would perpetuate the memory of what appears to have been Iowa's most powerful tribe of Indians.—*Muscatine Journal.*

THE LABORATORY THAT JACK BUILT,

OR THE HOUSE THAT JACK BUILT ON CHEMICAL PRINCIPLES.

A little nonsense now and then
Is relished by the wisest men.

This is the laboratory that Jack built.

This is the window in the laboratory that Jack built.

This the glass that lighted the window in the laboratory that Jack built.

This is the sand used in making the glass that lighted the window in the laboratory that Jack built.

This is the soda that melted with sand compounded the glass that lighted the window in the laboratory that Jack built.

This is the salt, a molecule new, that furnished the soda that melted with with sand compounded the glass that lighted the window in the laboratory that Jack built.

This is the chlorine of yellowish hue, contained in the salt, a molecule new, that furnished the soda that melted with sand compounded the glass that lighted the window in the laboratory that Jack built.

This is the sodium, light and free, that united with chlorine of yellowish hue, to form common salt, a molecule new, that furnished the soda that melted with sand compounded the glass that lighted the window in the laboratory that Jack built.

This is the atom that weighs twenty-three, consisting of sodium so light and free, that united with chlorine of yellowish hue to form common salt, a molecule new, that furnished the soda that melted with sand compounded the glass that lighted the window in the laboratory that Jack built.

This is the science of chemistry that teaches of atoms weighing twenty-three, and of sodium metal so light and free, that united with chlorine of yellowish hue to form common salt, a molecule new, that furnished the soda that melted with sand compounded the glass that lighted the window in the laboratory that Jack built.—*The Age of Steel.*

SPOUTING OIL-WELLS IN RUSSIA.

The principal oil-wells of the Baku district lie at Balaxame or Balakhami, about six miles to the northeast of the town: this is an oil-field about three and a half miles in length by one and a half in breadth. To the south lies a smaller field called Bēbeabat. One fountain at Balakhani, ninety eight feet in depth, is noted as having been flowing steadily for upward of two years, and still continuing to yield 800 barrels a day. Another well not far off, 490 feet deep, commenced its career by throwing up a jet thirty feet in the air, and then flooding

the land with oil for a considerable distance all around, overflowing other wells and several small refineries, so as effectually to stop their work. The roar of the rushing oil and gas could be heard a mile from the spot.

Various flowing wells are said to yield 6,000 barrels a day, and some far more; but, from the fact that these quantities are generally stated in the Russian measure of poods, it is not very easy to realize what is meant. One pood, we learn, is equal to thirty-six pounds English. Hence one thousand poods represent somewhere about sixteen tons. Accounts have just reached England of an oil-fountain which was struck last December, and flows at the rate of from fifty to sixty thousand poods daily, gushing forth with such force as to break in pieces a three-inch cast iron plate which had been fastened over the well in order to divert the flow in a particular direction. In the same district a huge heap of sand marks the spot where an oil-spring, on being tapped, straightway threw up a column of petroleum to twice the height and size of the Great Geyser in Iceland, forming a huge black fountain two hundred feet in height—a fountain, however, due solely to the removal of the pressure on the confined gas, for there is no trace of volcanic heat. The fountain was visible for many miles round, and on the first day it poured forth about two million gallons, equal to fifty thousand barrels.

An enterprising photographer who was on the spot secured a photograph which places this matter beyond cavil. The fountain continued to play for five months, gradually decreasing week by week, till it finally cleased to play, leaving its unfortunate owners (an Armenian company) well-nigh ruined by the claims brought against them by neighbors whose lands were destroyed by the flood of oil.—*From "The Oil-Supply of the World," in Popular Science Monthly for December.*

EDITORIAL NOTES.

THE present number of the REVIEW is an especially characteristic one, having no less than twelve original articles and communications, by Western writers, covering an unusual variety of subjects and equaling in ability and interest those of any other periodical of similar character in the country. Persons wishing to send off a periodical illustrative of the enterprise, education and talent of Kansas City and its environs should select this number.

WE omitted in our last issue to mention a very important scientific work that is being done at Washburn College, Topeka, Kansas, viz: "The Washburn Biological Survey of Kansas." It is in charge of Prof. F. W. Cragin, who is assisted by other members of the faculty and prominent scientists in various localities in the State. This work has been going on for about one year and the most interesting results have been attained, eliciting the encomiums of some of the best naturalists and biologists in the country. There results have been published in two Bulletins which will receive full mention in our next issue.

A SEVERE shock of earthquake was felt at Salt Lake City, Utah, on the morning of November 10th, at about 2 o'clock. Much alarm was felt but no harm was done. The tremors lasted about ten seconds. At Paris, Idaho, six shocks were felt about the same time, and from then till 4 o'clock. Con-

siderable damage to houses is reported, and people were affected as by seasickness. The first shocks were from north-east to south-west, then a swaying motion from north to south. The succeeding shocks were from east to west.

THE Kansas Academy of Science, a portion of whose proceedings we give this month, had an unusually good meeting at Lawrence last week. This Association is doing excellent work for the State of Kansas, and its recommendations should receive the careful attention of her legislature.

MR. C. A. NEWCOMB, of Colorado, is now in St. Louis superintending the publication of his work upon "The Mound-Builders" which will be ready about December 10th. We bespeak for it a favorable reception, as Mr. Newcomb is regarded as an authority upon this subject by his acquaintances.

DR. D. G. BRINTON, Professor of Ethnology and Archæology, Philadelphia, Pa., offers to receive and answer without compensation, questions relating to American archæology, ethnology and linguistics. He also asks that persons having specimens of an anomalous or unusual character send him descriptions, drawings or casts of them; also that he may be apprised of any typical and well authenticated collections that can be obtained for scientific purposes, and of any promising localities for archæological researches, or of any local publications on these subjects and the names of persons interested in thom.

WE are informed by a member of the Missouri River Commission that he tried in every way to secure early attention to the work needed near this place and urged its importance. The latter fact was self apparent to all. But each member of U. S. engineers said it was too late to begin work, that it could not be completed this fall and the winter ice would destroy it. With their experience the others had to agree in conclusion. An allotment of half the appropriation was made to be used at and near Kansas City, preparations to be made this fall and winter and work commenced as early as possible in the Spring.

PROF. S. H. TROWBRIDGE, of Glasgow, Mo., has been working for some years upon a text-book to represent and explain the practical, objective method of teaching science, and has it now in manuscript ready for publication. As a test of the correctness of his views and methods he has incorporated a few of the representative parts of the work in a little pamphlet and sent it out for the inspection and judgment of scientists among teachers and practical workers, for the sake of receiving their suggestions and criticisms. This pamphlet can be obtained by addressing him by letter or card at Glasgow, Mo. From a hasty glance at it, for it was received just as this issue of the REVIEW was going to press, we are satisfied that the work, of which it is a forerunner, will be found instructive and valuable both in matter and method.

THE National Board of Health has addressed a circular letter to the governor of each State in the union, calling attention to the prevalence of Asiatic cholera in Europe, its steady progress westward from India and Egypt during the past two years, and the danger of its reaching this country in 1885, unless prompt action is taken against its introduction through seaports. The circular advises that no point be left unguarded, for the present facilities for travel afford ample means for carrying the poison everywhere. The governors are urged to begin precautionary work at once, and to call the attention of the legislatures to the matter, and the organization of State Boards of Health is recommended.

THE National Academy of Science held its usual fall meeting at Newport this year, commencing October 14 and continuing four days. The spring meeting must be held, in accordance with the constitution, in Washington, the third Tuesday of April in each

year. The autumn meeting is peripatetic, and has generally been held in New York or Philadelphia. The National Academy acts as an advisory scientific council to the government, and its members are required to perform such tasks as the government may give them without compensation. The number of members is limited to 100, and membership is considered a high honor not easily to be obtained. Among those present were: President O. C. Marsh, professor of palæontology of Yale; Home Secretary Asaph Hall, astronomer of the National observatory; Treasurer J. H. C. Coffin, United States navy; W. H. Brewer, professor of agriculture, Yale; G. J. Brush, professor of metallurgy, Yale; Josiah P. Cooke, professor of mineralogy, Harvard; Edward S. Dana, professor of physics at Yale; Walcott Gibbs, professor of chemistry at Harvard; Julius Hilgard, superintendent of the coast survey; Samuel P. Langley, astronomer in charge of the Allegheny observatory; A. S. Packard, profossor of zoology at Brown University; Edward C. Pickering, director of the United States geological survey; Samuel H. Scudder, editor of *Science*, of Cambridge, Mass.; Wm. P. Trowbridge, professor of mechanics at Columbia College, and Francis A. Walker, president of Massachusetts Institute of technology.

THE Cattle Grower's Convention held at St. Louis in the latter part of November recommended, among other things, that congress at an early day relieve the department of the Interior from the supervision and care of the bureau of public lands, and that it, as well as the care of all public lands and their belongings, be transferred to the department of agriculture; and that the Fish Commission, now in the charge and direction of the Smithsonian Institute, be also transferred to the care of the department of agriculture; and that the bureau of meteorology now in the charge of the War department, be also put under the direction and charge of the department of agriculture, and further that the department be then advanced to the full rank and dignity of other departments of our government, and further, that the secretaries of agriculture should be selected, not only for their capacity for organization and administration of public affairs, but also as a pre-requisite requirement that they be familiar with practical agricultural operations and interests, and such officers should, by preference, be selected from that section of country which is pre-eminently agricultural and not from a section the greater interests of which are centered in manufactures or commerce.

FOR three years past there has been considerable excitement over alleged discoveries of gold in Northern Michigan. It now appears that gold has really been found in paying quantities in the upper peninsula, in the vicinity of Ishpeming, and that a number of companies have been formed for mining and reducing the ores, mills with the most modern machinery erected, etc. A rush of prospectors to these diggings is predicted for the next spring.

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of this Country and Europe, at a discount of from* 15 *to* 20 *per cent off the retail price.*

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THE *Atlantic Monthly* for December, 1884, presents the following attractive table of contents: In War Time, XXIII., XXIV., S. Weir Mitchell. Over the Andes, Stuart Chisholm. Francois Coppee, Frank T. Marzials. Penelope's Suitors, Edwin Lassetter Bynner. Two Harvests, Helen Jackson. The Lakes of Upper Italy, IV. Combination Novels, George Parsons Lathrop. These are Your Brothers," Olive Thorne Miller.

Among the Redwoods, E. R. Sill. Poe's Legendary Years, G. E. Woodberry. An American Flirtation, Grace Denio Litchfield. Canada and the British Connection, Edward Stanwood. The Contributors' Club. Books of the Month.

THE first number of the *Central School Journal*, a sixteen page (12x9 in.) monthly, devoted to practical education, will be issued about the middle of December, 1884. The *Journal* will be edited and managed by Profs. E. M. Guilliams and S. A. D. Harry, members of the faculty of the Salina (Kansas) Normal University. These gentlemen have had a great deal of experience as teachers in both Public and Normal Schools, and understand the requirements of a first-class Educational Journal.

THE danger of incidental harm to the community, or to certain classes of people, from the increased use of machinery, the extension of public works, etc., is greatly diminished when those who make the laws, and especially those whose duty it is to interpret them, recognize that law is a progressive science; that it is a means, not an end; that when a state of things arises for which there is no precedent, a new precedent must be made. How the most enlightened jurists hold this principle constantly in view, and how the common as well as the statute law is thus made to keep pace with the general advance of civilization, is admirably set forth in the leading article in the *North American Review* for December, "Labor and Capital before the Law," by Judge T. M. Cooley, of Michigan. To the same number, William K. Ackerman contributes some suggestive "Notes on Railway Management," Dr. Schliemann tells what he found in his excavations of the ruins of Tiryns, in Southern Greece, and Principal Shairp supplements his scholarly article on "Friendship in Ancient Poetry" with one on "Friendship in English Poetry." The other articles in the number are, "The British House of Lords," by George Ticknor Curtis, and "Responsibility for State Roguery," by John F. Hume.

Popular Science Monthly, conducted by E. L. and W. J. Youmans, is promptly on hand and contains the following articles: The Reformation in Time-Keeping, W. F. Allen, (Illustrated). American Aspects of Anthropology, E. B. Tylor, F. R. S. School-Culture of the Observing Faculties, J. C Glashaw. Queer Flowers, Grant Allen. Alcoholic Trance, T. D. Crothers, M. D. The Problem of Universal Suffrage, Alfred Fouillée. Cannibalism as a Custom, A. St. Johnston. Starvation—Its Moral and Physical Effects, Nathaniel E. Davies, L. R. C. P. The Chemistry of Cookery, W. Mattieu Williams. The Perils of Rapid Civilization, C. F. Withington, M. D. Religion and the Doctrine of Evolution, Frederick Temple, D. D. Liquefaction of the Elementary Gases, Jules Jamin. The Oil-Supply of the World, II. Oddities of Animal Character. Biographical Sketch of Edward B. Tylor, (With Portrait). Correspondence. Editor's Table: Science in School Management; The Abuse of Political Power; A Jewish Explanation of Jewish Success. Literary Notices. Popular Miscellary. Notes.

THE exceptional success of the Christmas Number of *Harper's Magazine* last year has led the editor and publishers to attempt this year to disappoint the public agreeably by giving them a still finer Number. The December issue contains no less than six separately printed plates, besides several other full page illustrations, the frontispiece being a reproduction, in the highest art of the wood-engraver, of the charming picture of the "The Boy Jesus in the Temple," by Prof. Hofmann of Dresden, one of the chief contributions of modern painting to religious art. The engraving is the work of W. B. Closson, from whose graver comes also in the same issue a reproduction of the "Flora" of Titian. The literary and artistic contents otherwise furnish an extraordinary and delightful variety of sketch, story, poetry, art, and music; while in the Easy Chair Mr. Curtis writes of "John Bull and Brother Jonathan at the Christmas Fireside;" and in the Drawer Mr. Warner has a pleasant prefatory word as to "The Universal Christmas Feast."

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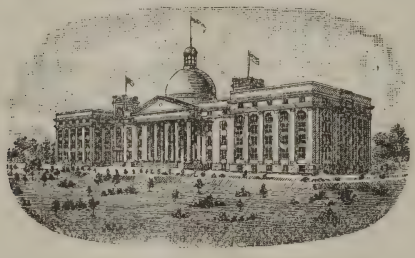
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TABLE OF CONTENTS.

PAGE.

GEOLOGY.
1. The Last Submersion and Emergence of Southeastern Kansas.* E. P. West 477
2. Practical Studies in Geology.* C. H. Sternberg 481
3. The New Artesian Well at Ft. Scott, Kansas.* E. H. S. Bailey and E. W. Walter. 485

ENGINEERING.
1. The Street Pavements of Kansas City.* W. B. Knight, C. E. . . 487
2. A New Street Car Rail. (Illustrated) 496
3. Problem of Rapid Transit Solved(?). 498
4. Stamped Railway Wheels 500
5. The Washington Monument Completed* 501
6. The Nicaragua Canal 539

BOTANY.
1. Vegetable Dissemination.* Rev. L. J. Templin. 507

PHILOSOPHY.
1. Religion and the Doctrine of Evolution 512
2. Rapid Changes in the History of Species. 522

ASTRONOMY.
1. Sun and Planets for January, 1885.* Wm. Dawson 523

PAGE.

NATURAL HISTORY.
1. Oddities of Animal Character 524

BOOK NOTICES.*
1. Second Annual Report of the Bureau of Ethnology, 1880-1. Government Printing Office 526
2. Travels on Faith from Tradition to Reason. G. P. Putnam's Sons . . 227
3. Primary History of the United States VanAntwerp, Bragg & Co 528
4. Report of an Archæological Tour in Mexico, 1881. Cupples, Upham & Co. 528
5. Proceedings of the Academy of Natural Science of Philadelphia, May to October, 1884. Edited by Edw. J. Nolan, M. D 529
6. Other Publications Received 529

SCIENTIFIC MISCELLANY.
1. Recently Patented Improvements.* J. C. Higdon, M. E 538
2. Thoughts on Science Teaching. Alexander Winchell 531
3. The National Exhibit at the New Orleans Exposition 536

EDITORIAL NOTES 539

ITEMS FROM PERIODICALS 539

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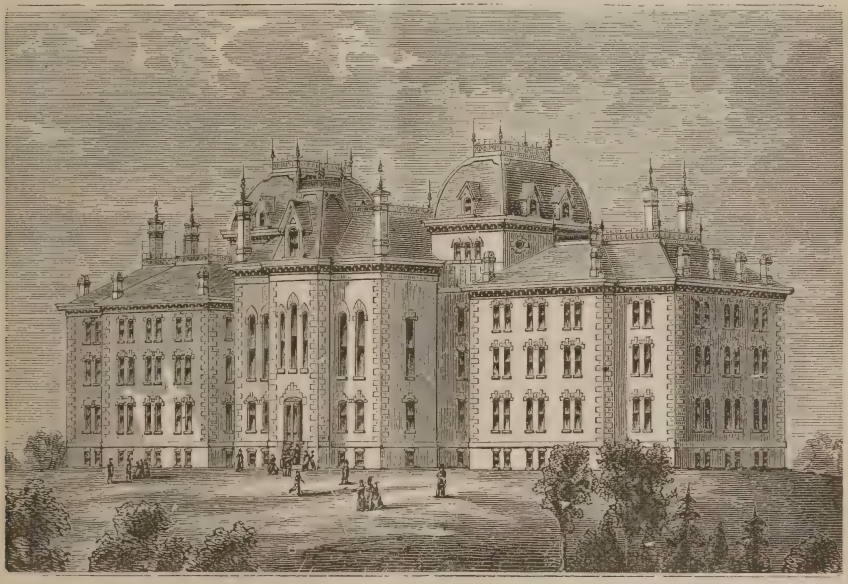
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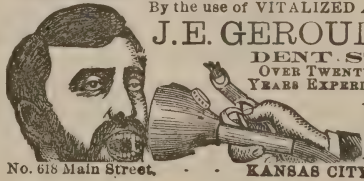
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REVIEW OF SCIENCE AND INDUSTRY,

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GEOLOGY.

THE LAST SUBMERSION AND EMERGENCE OF SOUTH-EASTERN KANSAS FROM THE CARBONIFEROUS SEAS, OR THOSE EFFECTING THE CARBONIFEROUS FORMATION IN KANSAS.[1]

E. P. WEST.

The country along the line of the Southern Kansas Railway, all through southeastern Kansas and extending westward to Harper, the present terminus of the road, is unsurpassed in beauty and the fertility of its broad fields and valleys. It is said, and truthfully, to be the paradise of the husbandman and stockman, and it is no less so of the geologist, the poet, and the artist.

Whoever has traveled over the line of this road cannot have failed to observe the picturesque and poetic beauty everywhere meeting the eye. Symmetrical mounds rise from the broad plains and valleys, as if by the work of magic, and terraced cliffs, terrace rising above terrace in solemn grandeur, environ the road. Sometimes the cliffs are circular, forming vast amphitheatres extending back for miles. These mark the last emergence of southeastern Kansas from the carboniferous seas, and bear unmistakable evidence of powerful and persistent forces which, though perhaps, comparatively brief, have left their impress boldly written on every feature of the country.

1 Read at the Annual Meeting of the Kansas Academy of Science, November, 1884.

Water-worn pebbles, commonly known as gravel beds, are found in the channels of streams, in the valleys under the soil, and over the highest mounds and ridges, all over the country. They are encountered north of Ottawa, and extend southward into the Indian Territory, westward to beyond Burlington, and eastward into the State of Missouri. How much beyond the limits indicated they extend I am unable to say, but it is probable that their range is much wider. This, however, can only be determined by an exploration of the adjacent country. Independent of their scientific significance, these beds are important in an economic point of view, affording free underdrainage and supplying good and convenient material for road-making. Along the bases of mounds and cliffs, and often for a considerable distance removed from them, as well as on the tops of the highest ridges and mounds, at and near the surface, the rocks often stand vertically to the plane of stratification, or inclined at various degrees from this tine. This is notably conspicuous in many places.

Not unfrequently old landslides are to be seen projecting from the mounds, or the brink of cliffs and extending out for hundreds of feet. Indeed, the whole country wears the appearance of having once formed the bed of shallow seas, divided into numerous channels of various widths, some of the cliffs during the recession of the waters perhaps forming coast lines while the higher lands may have been low islands. Such is the condition of things conspicuously marked over the entire area named.

To what cause is this grand work to be attributed? It could not have been done by rivers, for the pebbles, though water-worn, are too widely distributed for the work of the broadest of such streams. It was not effected by glaciers, for the vast land-slides, the conformation of the mounds and cliffs, the vertical position of the rocks, where the stratification has been disturbed, the absence of erratic rocks, and the lack of the commingling of the local rocks, all preclude this idea. If it had been caused by glacial action there would have been an intermingling of all the rocks torn down, indifferently. This, however, is not the case anywhere in the district observed. Neither are the beds composed of altered drift, for if they were so they would be homogeneous in their general distribution; but this is not found to be the case, for in some localities they are composed of chert alone, while in others they contain small broken fragments of sand-rock alone, in each instance identical with the adjacent local rocks. No erratic, trap, or igneous rocks, or limestone is anywhere to be found intermingled in the beds. The absence of trap and igneous rocks is accounted for from the fact that the glaciers did not extend so far south. The absence of limestone, though the prevailing local rock of the country, will be explained further on. It was not caused by volcanic action, upheavals, or folding of strata, for the under strata rest undisturbed.

Though evidently not caused by any of these agencies, the mounds, the terraces, the cliffs and the water-worn pebbles, and broad plains and valleys, are conspicuous, grand, and picturesque, facts which stand out in bold relief in the entire district, and prove a wide-spread destruction of its former surface. The

whole country, indeed, has been denuded for, at least, from fifty to two hundred feet in vertical thickness, leaving the more impregnable mounds and cliffs, the pebble beds, and broad plains and valleys, standing monuments to bear witness to the general destruction which, in a past age, took place. The power which caused it must have been great and persistent, and can only be determined by the evidence it has itself left impressed on the field of its operations, and which if correctly read, will, unerringly, lead to its detection. This reading points clearly and unmistakably to water aggregated in broad and shallow seas as the author of the stupendous work. The deposits of pebbles, clays, and soils, the great landslides, the mounds, cliffs, and terraces, and the inclination of the disturbed rocks, marking the country so persistently and conspicuously, could have been caused in no other way.

These seas were, no doubt, connected with an ocean, or deeper and more extended waters, lying to the southward and westward; but at what era of geological time is somewhat uncertain, except that we know it must have occurred since the carboniferous age, for the upper coal measures and Permian rocks are those destroyed.

Co-extensive with this area of devastation, as far as I have had an opportunity to examine it, and, I presume, co-extensive with its entire limits, there is scattered over the country, resting upon the surface or buried under the recent alluvial deposits, silicified wood which grew at a time intermediate between the carboniferous vegetation and our recent forests. The carboniferous wood is invariably imbedded in the stratified rocks, while this intermediate wood is invariably upon the surface, as resting under recent alluvial, or vegetable deposits. This would indicate that portions of Kansas, at least, were covered with forests at the time this widespread destruction began, and subsequent to the carboniferous age, portions of which must have been swept away and destroyed by the submergence of the country, while other portions of it, where the conditions were favorable, were silicified in the mineral waters of the seas and left scattered over the old sea-bed, in positions at or near where it is now found, when the land for the last time, in southeastern Kansas, emerged from the water.

The petrified remains of this intermediate forest, when its limits are fully known, may give some clue to the time of this era of denudation. To the westward, in the region of middle Kansas, the bones of species of animals now living, and the remains of man, have been found buried under alluvial deposits of wide occurrence, and at considerable depth below the surface. If the intermediate fossil wood should be found, as it probably will be, associated with these buried remains, it will render the probability great that this era of waste was comparatively recent, and that man may have reposed under the shade of the forests which preceded it, and which were involved in its devastations. But there is an equal probability that it may have occurred at an earlier date of the world's history.

This last era of submersion in Kansas seems to have been one of destruction, for no fossil remains of sea-life seem to have been left to indicate the age of

its occurrence, and to determine this, resort must be had to preceding life, or to synchronous air-breathing animals which may have been carried out by ocean currents and buried under their deposits.

The absence of life, or the fossil remains of life of this era are not to be wondered at when we consider the wide-spread destruction which took place in it. All of the lime rocks which were torn from their beds were destroyed, utterly, either by the chemical action of the acids in the water, or ground up by the attrition caused by waves and currents, or, most probably, by both of those causes combined, and carried away, in part, to distant and deeper waters, and in part left to form the soils of the local valleys. The more enduring silica was rounded by the action of the water and left in the beds so widely distributed over the country.

Where the destroyed strata were composed of limestone alone, no pebbles are be found, but where the lime rocks contained masses of chert, or where the strata were composed of chert entirely, the pebbles are found, and the beds vary in thickness in proportion to the amount of material torn down. Where the destroyed strata are in a locality of sand rock, and composed of sand rock alone, the gravel beds are composed of their fragments alone. There may have been, and undoubtedly there was, some drifting together of the pebbles, caused by the waves and currents of the sea, but in the main they are confined to the locality where they were torn down, and are nowhere of any considerable thickness.

There are now in the museum of the University of Kansas perhaps a hundred specimens of fossil shells collected from these beds at various and widely separated localities, identical with the undisturbed fossils of the respective localities where they were found, and which prove conclusively, if additional proof were needed, that the pebbles composing these beds are but the more enduring parts, or silica, entering into the composition of the local rocks destroyed. The silica, being impervious to the acids which aided the destruction of the lime rocks, remains imbedded where showered down from the general ruin, and as left when the land emerged from the water except where the beds have been since locally altered, to a limited extent, by rivers and other streams of water cutting through them.

I am aware that erosion, and changes in the elevation of land of continental extent occurred during Post Tertiary time; but it is not probable that all the changes happened at the same time, and we must look to the respective changed localities, to determine the relative ages when this work was done. In this paper I have considered southeastern Kansas only, and have attempted to sketch the condition of things wrought out by natural forces in it.

NOTE.—This subject will be continued in the next number of the REVIEW.

PRACTICAL STUDIES IN GEOLOGY.[1]

CHAS. H. STERNBERG.

Geology is a world study, and takes the earth as soon as it was cool enough to allow the atmosphere to disgorge its contents on the steaming earth.

Then began the operation of natural laws, and the causes and effects, as we see them to-day. The rain fell in torrents on the steaming earth, and washed away the solid rocks, and in shape of clay or sand the streams carried it to lower levels and deposited it on the bottom of the sea, as sedimentary rocks. The study of geology is the grandest of the natural sciences, not only because it takes into consideration the largest object with which we have to do, but it includes vast lapses of time, so long in fact that if it does not prove that time is eternal, it shows it least that it is very old. The text-books of the geological student are the solid rocks in which the Creator has written in never fading characters the history of each succeeding period, its life, climate, depth of sea, etc. All the natural sciences bring from their store-houses things new and old to increase its interest. If we go to the sea-shore, and notice the shells lying on the beach which an incoming wave covers with sand, or mud, we see the process by which fossils are made. The sea may come in and by pressure convert the sand, or mud, into solid rock, and the shells will be indefinitely preserved, and they represent existing species.

If we notice the accumulations at the mouths of great rivers, like the Mississippi, we find, mingled with the sand, or mud, trunks of trees, bones of animals, etc., that have been drifted from the far interior, a thousand miles perhaps. These are mingled with shells and sea-weed from the sea-shore, and represent the life of a continent. The sand and mud may, by pressure, be converted into rock, and the relics be preserved for ages. Petrifaction will take place. This is a slow process: as the contents of the organic cells decay they are carried away by water, which holds silica in solution; this is deposited in the empty cells, making a perfect cast, and so cell after cell is built up of silica. This as I said is a very slow process. In Pliocene time the bones are but partially petrified, while only in the older formations are they completely silicified. Another way nature has of preserving her records is by making casts of shells, leaves, sea-weeds, etc.; a leaf falling in the soft mud is covered up, and a perfect cast made of both sides. In some formations the lime of shells has been entirely carried off, and only casts remain. If we go to Florida we will see the process of rock making. Shells are mingled with the remains of others that the waves have ground to powder, which acts as a cement binding the shells together, strong enough to use for building material.

If we go into the hills and find in the solid limestone shells, sea-weeds, etc.,

1 Read before the Kansas Academy of Science, November, 1884.

we can but acknowledge that they represent the life of the period, when as soft mud, this limestone was lying in the bottom of the ocean. And so by natural causes have all the geological records been kept. Many people suppose that the study of geology is dry and stupid, of old bones and rocks. But there is no wider field for the imagination than to people the old seas and lands with animals restored from their buried relics, to clothe the ancient lands with verdure, and map out the continents, study their physical geography, the depth of the sea, climate, and above all to study the introduction and succession of life on the globe and other manifold changes brought about in the animal creation, their development from lowly forms, and their progression through successive changes, until the present state of perfection has been brought about. Life is too short to study the changes brought about by the lapse of countless ages. Mountains have been elevated, valleys hewn out, chasms drilled through the hearts of mountains and many other grand phenomena. The early geologists divided the world's history into distinct periods, supposing that at stated times whole genera were swept from the face of the earth, and new ones created.

These periods have been divided into *Palæozoic* or ancient life; *Mesozoic* or middle life, and *Cenozoic* or recent life. The first period in *Palæozoic* time is the *Silurian* or age of mollusks, and the enormous belts of limestone laid down attest to the abundant shell-life of the period. This was followed by the *Devonian* or age of fishes. They were all cartilaginous, and but few of their remains are preserved, the *Lepidosteus*, resembling our common gar-pike, then appeared, as well as sharks and rays. The last period in *Palæozoic* time is the carboniferous or age of coal plants. The air was dense with carbonic acid, and the luxuriant plant-life cleared the air of this poisonous gas, and stored it away in the great coal fields. Among the plants were the *Sigillaria*, *Tree Fern*, *Horse-tail*, *Cycads*, etc. The ground, and fallen wood, was covered with sponge-moss. At times the sea came in and covered the organic mass with sand, or mud. The rulers of the estuaries were great placoderms. They were clad in armour of bony plates, resembling shields and bucklers. Sharks and rays, with huge frog-like batrachians, were abundant. At the close of *Palæozoic* time *Cenozoic*, the age of reptiles, began. The first period is called Jurrassic, from the Jura Mountains. Here both on land and sea, enormous reptiles reigned supreme, and America has furnished some world-renowned monsters. In the Rocky Mountains, for a number of years, large bones have been found. People supposed them to be fragments of fossil wood.

In 1877 Professors Marsh and Cope made important discoveries, and published the results of their labors, thus adding another chapter to American palæontology. These were the largest known land animals and are called Dinosaurs. The larger ones reached a height of twenty-five feet and sixty feet in length. They were plant-eaters and fed on the leaves and tender branches of the luxuriant forests through which they wandered. The carnivores or flesh-eaters were smaller and more elegantly built for springing on the clumsy herbivores. They had on each jaw a single row of recurved, serrated teeth. The plant-eaters had several

rows. In the Judith River group the *Dinosaurs* walked erect; their front limbs were small, and armed with claws for grasping the branches of trees on which they fed. A ponderous tail helped to support their enormous weight. They had three rows of teeth in each jaw, with a magazine below each old tooth, containing five young ones. As fast as one row wore off another took its place. We found thousands of these cast-off crowns. The second period is called the Triassic. Here huge reptiles on sea and land were the ruling types. Some are called Labyrinthodonts from the peculiar manner in which the enamel of the teeth is folded. They were clad in armors of bony plates. Crocodile-like animals, with beautifully sculptured bones were common, as well as sharks, gars, etc.

In northern Texas the beds are made up chiefly of red clay, which is so finely divided that all the waters flowing from them, hold it in solution. During high water or on windy days, the water is as thick as cream. The next period is the Cretacous when the chalk of England and America was laid down. The first group in the west is called Dakota, by Prof. Hayden. The formation of red-sandstone, and variegated clays, were laid down in an open sea dotted here and there with islands. The formation enters Kansas near the mouth of Cow Creek, extending in a northeasterly direction through the State, Nebraska, Minnesota, British America and so on to Greenland. The trees, like those in our existing forests, then appeared. Here flourished the magnificent Red-wood, *Catalpa*, *Menispermites*, Tulip-tree, Cinnamon, Fig, *Sassafras*, etc. They left impressions in the sandstone of Kansas and Nebraska, and some two hundred species have been described by the noted palæontologist Prof. E. Lesquereux, of Columbus, Ohio.

During the Niobrara group great beds of chalk and blue shale, were laid down in western Kansas. Here appeared the first bony and edible fishes: *Portheus Molossus*, Cope, reached a length of twenty feet. It had a large bull-dog-shaped head with fangs projecting four inches from the mouth. It had another weapon of offense and defense in the shape of pectoral and dorsal fins, three feet long. In some species, one edge is serrated, and even in their fossil form are hard enough to be used for splitting wood. Another peculiar species was Cope's *Erysicthes* or snout fish. It used this weapon as a modern sword-fish does its sword. But the rulers of the deep open sea were the Saurians or sea-serpents. Cope's *Liodon poriges* reached a length of eighty feet. It had four powerful paddles, which by the aid of a long eel-like tail enabled it to go through the water at great speed. Its weapon of offense was a long bony snout, that was used as a battering-ram.

Clidastes tortor, Cope, was a small animal, about forty feet in length. It was provided with an additional set of articulations in the vertebræ to enable it to coil up, like a snake. Marsh's *Clidastes pumulus* was only twelve feet long, and doubtless often fell a victim to the sharks and other rapacious fishes that abounded in these waters. One peculiarity of these Saurians was that they had no expansible gullet, as in modern serpents; another method was given them in the shape of hinges of the ball and socket pattern just back of the dentry-bone. This en-

abled them to expand the cavity of the mouth and swallow large morsels, through a pelican-like throat.

The most interesting fossils found in the rich beds of western Kansas are Marsh's toothed birds. His *Hesperornis regalis* reached a height of nearly six feet. The wings were not developed. They were swimmers and lived on fishes. They were provided with a row in each jaw of sharp, reptile-like teeth, and thus nearly approach them. Many suppose that they were derived from reptiles; another proof is in the oldest of all birds, that had a long vertebrate tail; and the most important discovery in this line was made by Prof. Marsh this year in the Rocky Mountains, having found a small Dinosaur that walked. The metatarsals and carpals were united, as in all modern birds.

Great flying dragons, or *Pterodactyls*, were common, with stretch of wings of twenty-five feet. They were toothless and Marsh has made the new genus *Pteranodont* for them. Another very unique species was Cope's *Protostega gigas*. It measured twenty feet from one flipper to the other, and instead of the ribs being expanded and united, as in modern turtles to form a shell, they were separate. Instead of a shell, they were provided with great dermal plates, an inch thick in the centre, two feet in diameter and beveled off to a thin figured margin. One specimen found by my party in 1877 weighed 300 pounds after the matrix was removed. It was eighteen inches from one condyle of the lower jaw to the other. Great oyster-like shells, twenty-seven inches in diameter, were found. But we must leave this interesting group to go on to Cenozoic time, the age of mammals, which is divided into three periods—Eocene, or early dawn; Miocene, or middle dawn, and Pliocene, or recent dawn of the existing state of things. Great mammals roamed through the dense forests of the Rocky Mountain region, which was a level swampy country. The temperature was tropical, and plant-life luxuriant. Here we find ample material for the study of the ancestors of modern animals. The horse had many ancestors, and their remains have been eagerly sought for. In early Eocene time he appeared no larger than a fox, with five toes on the hind feet. The folds of the tooth enamel were simple; later on he had discarded his two side toes and walked on three, later still only one toe on each foot was in functional use. The side toes were like the dew claws of a dog. The enamel was complicated and resembled that of the recent horse, that has only the rudiments of these side toes in the splint bones, and so the ancestors of other animals have been traced. The camel has two toes, and the two metatarsals and carpals are united, a medullary canal extending the whole length of the bone on each side. I was so fortunate as to find a camel in the miocene of Oregon that had the two metatarsals and carpals entirely distinct. In the Loup Fork Pliocene I have been employed the present season, for the U. S. Geological Survey, and have been remarkably successful.

My party having procured 15,000 pounds of fossil vertebrates. They consist chiefly of three species of rhinoceros, the mastodon, camel, horse, a small deer, lion, etc., all from one locality. Great numbers of bones have been washed from some river into a deep hole, in the lake, and everything in connection with

them prove that the place of death was but a short distance from that of burial. The bones were scattered through sand on a bed of calcareous sandstone. Rhinoceros bones were the most abundant; Cope calls them Aphelops. They were without horns, and had large sharp canines in the lower jaw, and also in the premaxilla. These were oblong in shape and ground against the lower ones, keeping them always sharp.

In some cases the premaxilla was several inches longer than the nasals, and had doubtless a flexible trunk. They had three toes on each foot, and were about the size of existing species. These beasts lived alone in herds, no other animal, no matter how fierce, would care to attack or associate with them, for in addition to their sharp tusks, their skin was thick and folded. The bones were indiscriminately mixed. It was not uncommon to find camel vertebræ between the branches of the lower jaws. We found several skulls with lower jaws attached and one perfect front foot. All the others were scattered, except the Tibia and Fibula that were anchylosed together.

A large mastodon lived at this time with inferior tusks. In 1881 I discovered a perfect lower jaw, that measured five and a half feet from the point of the tusk to the angle of the jaw; the jaw was four feet long. This season I procured four upper teeth together in fragments of the maxilla. The largest was seven and a half inches long and three inches wide. Turtles were also common; in 1881 I procured twenty specimens from a narrow gulch. Some of the shells were beautifully sculptured. They were all land and fresh water turtles. But time will not allow me to go more into details. If I have been so fortunate as to interest some of you enough to go more deeply into the subject than I have to-day, I shall be most happy.

THE NEW ARTESIAN WELL AT FT. SCOTT, KANSAS.[1]

E. H. S. BAILEY AND E. W. WALTER.

Some months since a company was formed at Ft. Scott to sink a well for the purpose of obtaining gas. The well was bored to a depth of 621 feet, and although gas was not found, an abundant supply of water was struck.

The well was bored on the first bench on the south side of the Marmaton River, at the foot of the bluff and 550 feet from the channel. Above the mouth of the well is a bluff consisting of limestone, hydraulic cement rock, coal, fire-clay, and bituminous shale. The diameter of the well is eight inches down to 335 feet, to which point the well was tubed with iron pipe. Below that point the well was bored dry forty-five feet, at which point a fourteen inch crevice was struck and salt-water rose to within ten feet of the surface. The boring was continued till a depth of 621 feet was reached, and on removing the drill a clear steady flow of over 10,000 gallons of water per day was obtained. There seems

1 Abstract of a paper read at the Meeting of the Kansas Academy of Science, 1884.

to be a continuous flow, with but little gaseous agitation. The pressure will carry the water to a height of five feet above the mouth of the well. The water remains at this height till the altitude is diminished.

The drill record, which follows, as well as other interesting facts, were furnished by E. F. Nave, Esq., of Ft. Scott:

Wash-Dirt	25 feet.
Clay	5 "
Soapstone	15 "
Slate	3 "
Coal	2 inches.
Soapstone	15 feet.
Slate	2 "
Coal	2 inches.
Soapstone	17 feet.
Blue Limestone	3 "
Soapstone	95 "
Soft Sandstone	5 "
Soapstone	70 "
Brown Sandstone	25 "
Grey Sandstone	7 "
White Sandstone	25 "
Slate	12 "
Fire Clay	4 "
Soapstone and Clay	10 "
Slate and Iron-pyrites	5 "
Flint	23 "
Flint and Limestone	14 "
Crevice	14 inches.
Limestone	4 feet.
Limestone and Flint	75 "
Very Hard Flint	5 "
Mixed Flint and Limestone	156 "
Total	621 feet.

An analysis of the water shows it to have the following composition; the weights being estimated in grains per U. S. gallon of 231 cubic inches:

Hydro-Sulphide of Sodium	.188 grains.
Chloride of Sodium	79.471 "
Bi-Borate of Soda	2.204 "
Chloride of Potassium	Trace.
Chloride of Lithium	Trace.
Chloride of Magnesium	7.987 "
Chloride of Calcium	.787 "

Sulphate of Lime	.829 grains.
Bi-Carbonate of Lime	14.238 "
Bi-Carbonate of Magnesia	.305 "
Bi-Carbonate of Iron	1.006 "
Sulphate of Soda	Trace.
Silica	.951 "
Organic Matter	1.166 "
Total Solids	109.132 "
Sulphuretted Hydrogen Gas	Trace.
Carbonic Acid Gas	Trace.
Temperature of Water	67½°.

This may be classed as one of the sulpho-saline waters, containing borax and lithium as rare ingredients. Comparing this water with that of other springs and wells, we find it to be similar to the celebrated "Blue Lick" Spirng of Kentucky, except that the Ft. Scott water is more dilute and the former does not contain borax. From a consideration of the strata through which the well passes and the composition of this water, it seems probable that it is a mixture of waters from different depths.

UNIVERSITY OF KANSAS, Lawrence, December, 1884.

ENGINEERING.

THE STREET PAVEMENTS IN KANSAS CITY.[1]

W. B. KNIGHT, C. E.

There is nothing more characteristic of a city, and nothing which in such a conspicuous manner marks the distinction between a city in fact and a city in name, than the condition of its public thoroughfares. It is a sign more extensive and obtrusive than any other kind of public improvements. The difference between a clean, smooth, easy riding carriage-way and the rattle and jolt over a rough roadway with varying conditions of mud and dust, must inevitably form an important factor in any estimate or judgment of a city. It is, perhaps, a difference which may rank even with climatic influences in effecting the prosperity, temperament and other characteristics of a population.

Well paved streets in a city are at once the exponent of its commercial vitality and a mark of the wise exercise of municipal power for the conservation of a most important element of that vitality; an element as important to the health,

1 Read before the Civil Engineers' Club of Kansas City, November 29, 1884.

growth and prosperity of the body politic and commercial as the free circulation of blood in the veins is to the individual man.

It is the object of this paper to describe as briefly as may be done, the manner in which this city has paved its streets, the conditions precedent and relative thereto, and the extent to which this kind of public improvement has been carried in the short space of two years and a half.

Kansas City is divided topographically into two distinct parts, the main portion of the site being a high, broken ground, elevated 100 to 200 feet above the Missouri River, and the smaller portion being level "bottom land" lying beyond the base of the bluffs and only about twenty-five feet above low-water mark.

The soil of the upper town is a rather yellowish clay containing generally a small proportion of silica, and most of it is suitable in its natural state for making brick of fair quality. Some of it, however, contains too large a proportion of lime. It is very compressible in its natural state, rapidly forms into ruts and depressions under ordinary traffic on newly graded streets, even where formed entirely by excavation. It softens easily and becomes slippery, and is of greasy appearance. when moistened. Flowing water washes it away rapidly and carries a large proportion of it in suspension to fill up low places when the current is checked. It cakes to a hard crust under influence of drought and summer suns, pulverizes to fine dust under traffic, and cracks open during the severe frosts of winter.

The street gradients in the main part of the city may be stated as ranging from two to five per cent on the north and south streets, and generally about half as great on the streets running east and west—although on some of the latter are found the steepest grades in the city—varying from six to thirteen per cent. These occur on streets crossing Main Street, and in the central business portion of the city.

Notwithstanding these steep gradients, the loads actually hauled over them every day are very heavy and the wagon tires generally much below the proper width. The city ordinance passed last year requires a three-inch width of tire for loads up to 3,000 pounds, and a four-inch tire for loads not over 6,000 pounds. As a matter of fact, hewever, loads of 7,000 pounds are commonly hauled on wagons with two and three-quarter inch tires, and the ordinary two-horse wagons, carrying loads of 3,000 to 4,000 pounds, have tires usually only two inches wide.

The heaviest load of which I have information was hauled recently, being a piece of machinery for the Cable Railway Company, which weighed 22,400 pounds, and was hauled by eight horses on a wagon with three and three-quarter inch tires. It is estimated that 13,400 pounds of this load was on the rear wheels.

In the lower town the natural soil is a fine, light sand, which becomes saturated with water during flood stages of the river and in which there has been deposited, in the artificial process of filling up, a top layer of clay and debris ranging from one to three feet thick.

The widths of streets vary from fifty to ninety-nine feet, a majority of the

principal streets being sixty feet wide. A general law of the city makes the roadway three-fifths of the total width.

Street railroad tracks are usually of four feet gauge, laid four and one-half feet apart. The lines are as a rule, double track on business streets.

The rock found in and about the city is a common limestone—most of it very soft; there are, however, some ledges of hard blue limestone, and one of dark flint-rock. At Argentine, about four miles out of town, and at Edwardsville, are found considerable deposits of limestone in ledges, varying in quality from soft calcareous to firm granular rock containing a large percentage of silica.

The work of paving the streets of Kansas City may be said to have begun, properly speaking, in the spring of 1882. At that date there were ninety-three miles of streets within the corporate limits of the city, of which fifteen miles had been Macadamized, the remainder being simply dirt roads. This work was done at intervals during the preceding ten or fifteen years under substantially the Telford-MacAdam specifications, and consisted of a layer of stones eight inches deep roughly set on edge, with four inches of stones broken to two and one-half inches diameter spread on top. The sub-grade was not rolled or compacted in any way. The larger stones used were very irregular in size and shape, and were not carefully placed. The top layer was put on in one course without rolling or binding in any way, and the quality of the stone used was generally of the more accessible and softer kind.

This class of work was mainly confined to the principal thoroughfares and is very unsatisfactory in its results. The stone wears away rapidly under the heavy street traffic, or becomes pounded down into the soft clay underneath, so that in dry weather the surface is very rough and uneven, and in wet weather the streets are almost impassable. Repairs have consisted of simply dumping wagon loads of broken stones into the worst holes and ruts and leaving it to be compacted by the travel on the street.

The first cost of this kind of street improvement was about fifty-seven cents per square yard. The cost to the city at large every year has averaged, I estimate, $1,000 per mile, although, probably, on some of the main traffic streets, the cost has been much above the average. Correct figures are not obtainable.

The stone for repairs is furnished without first cost, and the breaking is done by the work-house prisoners at a nominal expense.

In the spring of 1882 all of the principal streets were in very bad condition. The first contract for paving any street otherwise than by Macadamizing was let February, 1880, and included that part of Fifth Street between Broadway and Bluff Street. The specifications called for Medina (N. Y.) sandstone, cut after the Belgian form, six to seven inches deep, laid on a six inch bed of coarse sand, and with the joints between the blocks filled with asphalt paving cement. The cost was $3.50 per square yard. The work was not, however, completed until January, 1883. Meanwhile the second contract had been let, in February, 1882, for paving that portion of Wyandotte Street between Fifth Street and Ninth Street with round white cedar blocks, six inches long, set on one-inch boards, bedded

on three inches of sand. The spaces between were rammed full of sand, and a coating of asphalt paving cement spread over the surface. The cost was $1.75 per square yard.

These two contracts were not preceded by any special public consideration of the subject generally, and were, as to kind, mainly the result of accident and individual interests.

The question of the proper kind of pavements for our streets came up in June, 1882, prominently in connection with the improvement of Sixth Street, between Delaware and Bluff Street. This street had just been regraded so as to form a new avenue for travel to and from West Kansas, and with the expectation, which has since been realized, that it would immediately become a main thoroughfare and leading business street.

Under the law of this city, the paving of any street cannot be done by the authorities until the owners of property along the street, representing the majority of the front feet (exclusive of non-resident ownership) shall formally petition the common council to have the work done. It is also necessary that the property-owners shall specify substantially what kind of pavement they want laid down. The entire cost of the work is assessed against the property fronting on the street.

The property-owners on Sixth Street selected a committee to consider the various kinds of pavements suggested, and finally decided, upon my recommendation, to put down a substantial concrete base nine inches thick, with a cedar block seven inches long for a wearing surface. The specifications which I prepared at this time have governed, without material change, all work of this character done since then, excepting that the thickness of the concrete foundation is made on some streets six inches, instead of nine, as on Sixth Street, and six-inch blocks have been put down on some of the streets instead of seven. The leading features of the cedar block pavement, put down in this city, are as follows:

The roadway is excavated to proper depth, and made to conform to the shape to be given to the finished surface of the pavement. Care is taken to secure, as far as possible, uniform density of the sub-grade, by the use of a two-ton roller, (the only one available), and by filling in soft spots with broken stone and ramming them down into the soil.

On this sub-grade is placed a layer of hydraulic cement concrete nine inches thick on some streets, and six inches thick on others, depending principally on the character of the formation, location, and character of the street, whether it is a business thoroughfare, or a street in a residence part of the city. In an exceptional instance the depth of the foundation has been reduced to four and one-half inches by the property-owners, although, generally, the popular disposition has been in favor of the nine-inch base on streets of all kinds.

The concrete is composed of five parts by measure, of clean limestone, broken to go through a two and one-half inch ring, and two parts of clean coarse river sand, with one part of approved hydraulic cement. The sand and cement are thoroughly mixed dry, and then wet, and the mortar spread over the stones, which

are spread out in a layer in a box. The mass is then thoroughly mixed together and loaded out into a wheelbarrow, deposited in place, and rammed until the mortar flushes to the surface. The cement is required to stand thirty-five pounds tensile strain per square inch after twenty-four hours. The brands used have been "Fort Scott," Kas., "Milwaukee," and various kinds of Louisville. On the surface of the concrete, which is made to conform to surface of street, a layer of sand is spread about one-half inch deep, or sufficient to fill up all the minor irregularities of the surface of the concrete, and make an even bearing for the blocks. The blocks are of white cedar, varying from four to eight inches in diameter, and are required to be cut from good sound live timber. They are usually seven inches long when set on nine inches of concrete, and six inches on the lighter base. They are sawn with parallel ends by gang saws, and are laid up as close together as practicable in the street. The interstices between the blocks are twice swept full of gravel, which ranges in size from one-quarter to three-quarters of an inch, and rammed down with round-pointed iron rods. After the first ramming, the surface of the block is made smooth and uniform wherever it may be uneven by going over it with a light paving rammer.

Asphalt paving cement, composed of coal-tar, distilled at 300° to 400°, and mixed with fifteen percent of mineral asphalt, is poured hot over the pavement, filling up all the minor interstices between the blocks. A thin coating of sand is then thrown over the surface before the asphalt dries.

The first prices at which this kind of pavement was let were $3.25 and $2.96 per square yard, for parts of Fifth and Sixth Streets, in the spring of 1882. This was for seven inch blocks on nine-inch concrete. Since then the cost of this work has been constantly decreasing with each successive letting. The last work contracted for was let at $2.44, and the average price paid during the season was $2.56. For six-inch blocks on six-inch concrete, the price has varied from $2.32 on the first, to $2.18 on the last contract let.

The ordinary wages for common labor has been $1.75 per day. The materials used cost about as follows: Seven-inch cedar blocks, eighty to eighty-five cents per square yard measured in the street, and six-inch blocks about seventeen cents less. For gravel, ten to twelve cents per square yard of pavement with seven-inch blocks. For asphalt paving cement, fifteen to eighteen cents per yard. The broken stone for concrete costs $1 per cubic yard, and sand about the same. Cement varies from $1 to $1.25 per barrel of about 260 pounds. The concrete in place is worth about $3.50 to $3.75 per square yard. One block of seven-inch cedar block pavement has been laid during this year on one-inch boards with four inches of sand underneath at a cost of $1.95 per square yard.

Observations of the wear of cedar block pavement with concrete base show a good, smooth surface and very uniform wear.

Blocks taken up at the intersection af Fifth and Main Streets, in the center of the business part of city, eighteen months after laying, showed a very regular wear of one-quarter to three-eighths of an inch. Blocks taken up for water and gas connections on the most crowded parts of Fifth and Sixth Streets, where

nearly all the heavy loads are confined to the ten and one-half foot strip of paving between the railroad track and the curb, show a wear of about three-eights of an inch in nearly two years.

There has been no repairing done on these streets, and there is no indication that any will be for some time. At all places where the pavement has been broken into, the concrete is found to be hard and compact. In one instance it was carrying the traffic of the street over a hole four feet across underneath. The bituminous concrete between the blocks has always appeared well formed, with but few voids occasionally near the bottom. The blocks are so thoroughly fastened together that sections of four to six square feet have been taken up without breaking. No swelling of the blocks and raising from the concrete has been observed. In very cold dry weather fine cracks appear running nearly directly across the surface of the pavement. They usually occur on steep grades and open from one to one and one-half inches if the extreme low temperature continues, but close up again with warmer weather.

The first stone pavement laid after the Medina stone, on a part of Fifth Street, was on a part of Bluff Street. Owing to the exceptional location of this street, no petition from adjoining property-owners could be expected, and in view of the public importance of this thoroughfare an appropriation of $15,000 was made out of the general fund to pave it. It was expected that a sufficient thickness of the old MacAdam metal would be found to form a good foundation on most of this street, considering the tons of broken stone that had been hauled there during the previous years. In the absence of this the specifications called for a six inch concrete foundation, which, in fact, was found necessary over the whole street. On this was placed a layer of two to four inches of sand. Rectangular blocks of the Argentine, or other good quality of native stone, was used for the wearing surface on my recommendation. The work could not be put under contract until late in the season, and consequently the eastern half, below Sixth Street, was prosecuted during the worst kind of winter weather—with the subgrade constantly wet from side-hill drainage, rains and snow, and was dug up to considerable extent by the gas company.

New quarries were opened and much of the stone laid in frosty condition on frozen sand; only the most urgent public necessity could justify doing the work under these circumstances. The western half remained unpaved and in nearly impassable condition, until early in the following spring. Meanwhile the large volume of the heaviest traffic in the city was turned on to the new pavement. This pavement cost $2.95 per square yard, or about $2.35 exclusive of the concrete base.

A line of three-inch agricultural tile drain pipe was laid along each side of the street near the gutters—that on the east side being for the purpose of draining the wet soil at the base of the hill, along which it runs—and that on the west side for sub-drainage and protection of retaining-wall.

Observations of the wear of this paving show numerous minor depressions of the surface, principally along the east side, and are due partly to unequal

wear of the blocks, and partly to settling of some of the numerous excavations made and imperfectly refilled, just in advance of the pavement. The principal objection to this stone is the variations in quality and consequent unequal wear. Although the effort was made to secure, by inspection at the quarries and on the ground, uniformity in quality, still the result shows that this has not been fully attained, and is, I think, impracticable for large quantities under the existing conditions. A large proportion of the stones indicate good wearing qualities, and will probably last for fifteen years, but the more rapid wear of the softer kinds makes a rough pavement and brings undue wear upon the others.

This material is extensively used by the street railroad companies for paving between their tracks, without any special selection as to quality used or shape of blocks, and without adequate foundation or care in laying.

A very superior quality of sandstone block pavement has been laid during the past season on Union Avenue. The stone is a firm, small-grained, metamorphic sandstone of pinkish color, quarried in the foot-hills of the Rocky Mountains, in Boulder County, Col. It lies in well defined and fully separated ledges varying in thickness from one inch to several feet. The ledges selected for paving stones are from three to four and a half inches thick, and the blocks are cut out from eight to twelve inches long and six inches wide. The Union Avenue pavement has a concrete base of nine inches, with two inches of sand on top, and has the joints swept full of sand. The side joints are smooth, corresponding to the natural top and bottom beds of the stone in place, and the ends re-cut to lay to one-half inch joint.

This pavement cost $5.38 per square yard, or about $4.25 exclusive of concrete. The stone costs on cars here, about $2.50 per square yard, measured as laid. Portions of this pavement that has been under heavy and continuous traffic since first put down, indicate excellent wearing qualities. A part of Mulberry Street, West Kansas, has also been paved with this stone, on a nine-inch bed of sand, with a well prepared sub-grade. East Ninth Street, from Main to Grand Avenue, is now being paved with the same material, on six inches of concrete. The grades on these two blocks are eight and thirteen per cent.

Walnut street from Twelfth to Twentieth, about 4,600 feet, was macadamized last year. The stone was carefuliy selected for hardness, and was broken to size from three and one-half inches to two inches. They were spread on in three layers, one of five and two of four inches each, making a thickness when rolled of thirteen inches at centre of roadway, and eight inches at gutters. The top layer is of very hard flinty rock and was mixed with a binding material of sand and clay; the only roller available was an old one weighing about 4,000 pounds and was altogether too light to compact the metal. There was considerable travel over this street while the work was in progress, forming well-defined ruts in the loose stones along the center. The street has been carrying a large and heavy traffic for a year now, and is in very good condition, although it has had no repairs at all. This work cost sixty-three cents per square yard.

A portion of Hickory Street, in West Kansas, about half a mile long, was paved under the Telford-MacAdam specifications, at a cost of seventy-eight cents per square yard. It has had no repairs since completed, and has been carrying a very large traffic with reasonably satisfactory results. The character of the pavement on these two streets, was due, in the case of Walnut Street, to the strong preference of a few active property-owners; and in the case of Hickory Street to the impracticability of getting a majority of the property-owners to agree upon any better kind.

A large amount of good macadam pavement might properly be put down on certain streets, provided the city had a heavy steam roller to use in construction, and, in addition, a well organized and equipped force to make repairs. Under present circumstances I think it is bad policy to improve streets—especially business streets like these—in this way.

All the materials used and the execution of the work is under constant supervision—one, and frequently two, inspectors being assigned to each piece of work. The whole work is under the immediate charge of the Superintendents of Construction, and care is taken to insure good workmanship and a substantial compliance with the specifications throughout.

The drainage system of the street surface is from the center each way to the gutters, and along the gutters to sewer inlets at nearest street corners.

The standard form for paved streets makes the pavement at the center of the street level with the curbs, and thence sloping down on curved lines to eight inches below this level at the curb line, excepting in the case of macadam streets, which are designed to have twelve inches fall to the gutter. Considerable variation, however, is found to be necessary on account of the existence of single or double lines of street railway tracks along the center of the roadway, and frequently on account of streets where the old established grade varies from "level across" to three feet higher on one side of the roadway then on the other. Some modifications are advisable, too, in cases of steep longitudinal grades, but the general purpose has been not to make the cross-slope greater than eight inches in eighteen feet, and to make the gutter not less than six nor more than twelve inches deep.

Starting in tne spring of 1882 with seventy-eight miles of dirt streets out of the total of ninety-three miles in the city, and the remaining fifteen miles of old Telford-MacAdamized streets which included all of the business streets, the work of paving done since then has been at follows:

	Miles paved.	Cost.
In 1882.	0.98	$ 31.137
In 1883.	2.63	132.755
In 1884.	9.03	442.167
Total	12.64	$606.059

We have taken up five and two-thirds miles of old MacAdam pavements and replaced them with stone or wood blocks.

	Miles.
There are now in the city, of old MacAdam pavement, about	9.3
Of new MacAdam	1.3
Of cedar blocks on concrete foundation	9.6
Of stone blocks on plank foundation	0.64
Of stone blocks on concrete foundation	0.7
Of cedar blocks on sand foundation	0.4
Total paved streets	21.94

Most of this work has been done on streets in the business part of the city. The work projected for next year will probably increase our mileage of paved streets by eight or ten miles, although as the initiative of this matter must in every case be taken by the owners of property on the streets, it is difficult to predict what the extent of work will be.

Excavations in newly paved streets have been carefully attended to with the object of preventing this prolific source of destruction to pavements. Permits are only given to parties who have obtained a proper license after filing a bond of $1,000 and depositing $25 in cash with the city treasurer, subject to the order of the city engineer. The conditions I have required of all parties who desire to make excavations in paved streets for gas, water and sewer connections, provide that the trenches shall be refilled with small broken stones, mixed with only a moderate proportion of clay, put in and thoroughly rammed in twelve inch layers. The sides of the excavation at the top are sloped out and double the original thickness of concrete put in, and the blocks replaced in a workmanlike manner. A special inspector is employed for the purpose of securing good work. As a rule, this has been accomplished and the pavement restored to its original condition and without subsequent settlement. This is considered a very important matter, and the requirements are based upon the principle that no individual has the right to damage a street pavement if it is practicable to prevent it. The Water-Works Company and the Gas Company have a general right to dig up the streets without legal restrictions, which is essentially wrong in principle, but practically, in this city, these companies have usually manifested a disposition to comply with proper requirements.

The general law of the city requires that railroad companies shall pave the space between the rails of all tracks, and a space of eighteen inches on the outside of each rail in the same manner as the roadway outside of such tracks may be paved. Great difficulty has, however, been experienced in getting this work done right, and practically the paving done by the companies is of a very inferior kind.

A good deal of special argument has been made against the use of concrete on that portion of the street to be paved by the company, as impracticable, but I am of the opinion that it is not quite practicable to use the concrete foundation,

but that it is eminently desirable that it should be so done, and that the foundation for all the paving should be uniform on every part of the street.

Some modification of the present method of track construction is advisable along streets with a concrete base, and it would appear to be a good, sound principle of public policy that the track paving should be made to conform to the street work, rather than that a special and objectionable modification should be made to suit the interests of the railroad companies.

In conclusion, I would express my opinion that the use of the concrete base, which is a characteristic feature of street pavements in this city, is right and proper. It is the most essential feature of a good street pavement, and it is noteworthy that this foundation should meet with such popular approval, and that this new city should be the first in the country to start right in this vexed problem of street paving. The main part of the street pavement is down for all time, and the wearing surface may be renewed when worn out, or changed and improved, as may be hereafter deemed best, at comparatively small cost.

I venture the prediction that Kansas City will, if this plan is continued, waste less money and profit more by the experience of the world in this matter than any other city that can be named.

A NEW STREET CAR RAIL.

The owners of light vehicles, the street car companies, and the stranger within our gates will be glad to be informed that a tramway rail has been invented which not only admirably serves the purpose for which it is designed, but can be laid in such a way as to leave the street as smooth as though it was not there. A rail of this kind is now in almost general use in the principal cities of Great Britain, and is found to work admirably. Its cost is not greater than that of the very objectionable T rail now in use here; it can be laid in almost any kind of asphalt, macadam, or stone block pavement without wooden ties or stringers, and when once laid becomes almost permanent.

Leaving out altogether the damage done to vehicles, the question whether or not the beautiful streets of our city are to be ruined by these tramways is one which should be carefully considered. I remember very well the appearance of some of our streets when I left home last summer. On Pennsylvania Avenue the unsightly appearance of the cobble-stones and the paving adjacent to the rails made a disagreeable impression. In some places the concrete extended to the rails, and in other places stonework extended for a short distance, alternating with the concrete. In some places whole slabs of stone, four or five inches wide and four feet long, were placed next to the rails. There was no symmetry whatever in the whole track and it resembled altogether an immense patchwork. When repairs were made no attention seemed to have been paid to making the track even or level, and, in consequence, numerous hillocks of cobble stones were the result. On Seventh, Ninth, and F Streets these evils were increased

by the numerous ruts in the space between the tracks as well as along side the rails. These ruts were caused by wagons having a broader gauge than the tracks being compelled to make use of them for various reasons. I suppose these matters have not claimed the attention of the commissioners.

The tramways in Liverpool are the perfection of the system employed on this side of the water, and I will endeavor to give you a crude idea of their appearance and construction. The Liverpool lines as now laid are conclusive proof that when tramways are well designed and properly constructed there is not the slightest impediment even to the narrowest-wheeled vehicles. The formation of the proverbial rut is impossible with this tramway and after completion it presents a symmetrical and smooth surface of great durability. The grooved rail I have mentioned is best shown by the following illustration, and in connection with it I have drawn the wheel in use. The groove is about three-quarters of an inch wide and the flange is in the middle of the wheel:



FIG. 1.

The following figure represents a section of the foundation and the track as completed. It will be seen that the rail is flush with the granite blocks and the latter on a level with the surface of the paving of the street, which in Washington would be the concrete shown in the illustration:

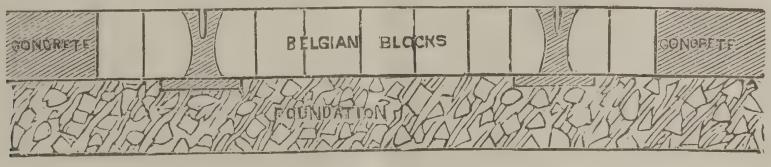


FIG. 2.

The bed or foundation consists of concrete mixed, and laid in the manner usually adopted for our street work, and formed to within about seven inches of the surface of the street. The surface of the concrete is carefully finished to the exact cross section of the paved roadway. This concrete consists of six parts of perfectly clean river or sea gravel, and eight of hard stones broken as angularly as possible, to one part of Portland cement.

The space between the rails and track and for eighteen inches on either side

of the roadway is paved with Belgian blocks. The sets are squared throughout, accurately gauged and laid in straight and properly bonded courses, and evenly bedded in concrete. The joints of the sets are filled with cement. These blocks resting on a firm foundation, there is no possibility of the settling of the roadway.

The cost of building a tramway of this kind is small in comparison with its great durability and the great blessing it would be to the public. If this tramway is introduced in America, and in Washington particularly, it will be a complete success and give entire satisfaction to the public.—*Correspondent National Republican.*

THE PROBLEM OF RAPID TRANSIT SOLVED (?)

Mr. John R. Abbe, an engineer of St. Louis, has proposed a scheme for rapid transit, which for ingenuity and magnitude exceeds any yet offered to the public. It is the result of two and one-half years' labor commenced while in Manchester, England, and finally concluded in St. Louis.

The first condition requisite for this great railway, according to Mr. Abbe is that the road-bed have no curves of less than 3,000 feet, and no grades of more than twenty-seven feet to the mile. This would in the construction of the road necessitate the removal of mountains and the filling up of valleys, but these are some of the obstacles that the capital required is expected to overcome. The reason for making the curves so gradual and the grades so slight is, as may be easily conceived, on account of the tremendous rate of speed at which this ideal express train will travel. It is also necessitated in part by the width of the track, which will be, when constructed, nine feet between the outer rails.

These rails will, when laid, be of ordinary pattern, though heavier than the ordinary rail, or with a face of about four and a half inches. Midway between the outer rails, will rest another of the same weight, but different in pattern, being angled on both sides from the top. The reason for having this rail angled is that on either side of it may run friction rollers connected with the car, which will thus be guarded against the likelihood of a leap into space when it is progressing at the rate of three miles a minute between the two great metropolitan cities of the United States. All three of these rails will be seven inches high, with a base of seven and one-half inches resting on ties of metal. The entire road-bed, when laid out, will be fenced in from communication with the world and all cities, towns, streets, country roads, and cattle will have to keep out of the path lest they should delay the progress of the ideal express.

The road-bed having been laid out, the ties and rails placed in position, and a glass roof placed over the whole. Mr. Abbe presented a plan of the engine and cars which are expected to overcome the forces of nature, or, rather, utilize her power in overcoming the obstacles which she has placed in the way of rapid travel. The care which takes but a passive part in the performance, is iron-

plated. The first train may, in honor of the event, be silver-plated, but the general idea is that, for the preservation of the cars, they be covered with sheets of metal or be constructed of metal throughout. The general shape of the conveyance will be that of a cigar.

For the engine which is to travel over the rails at such a tremendous rate of speed, Mr. Abbe has devised several improvements in cylinders, valves, seats, etc., which, as they are of value to him and he hopes to have them patented some day, are not described here. The general appearance of the engine is that of three huge wheels preceded by a sloping frame and followed by a tank, from the top of which rises a short smoke-stack. The tank contains the water which is scooped up in transit from huge troughs between the rails. Through the tank to the smoke-stack runs a pipe which, coming from the fire within the boiler, heats the water in advance. Beneath this tank is a center-pin truck, with two pair of weels, a companion to which supports the head of the locomotive. Upon these trucks rests the huge framework, which is bowed like a bridge and whose oscillations, according to Mr. Abbe, will therefore be vertical, and not horizontal. The driving-wheels which propel this piece of mechanism are to be three in number, resting upon three rails. The center wheels runs quite ahead of the other two, but the pistons which operate it work from the other side of the same steam-chests that furnish the power that propels them. The driving-wheels may be flanged or not, according to the desire of the passengers. The engine will be held upon the rails by the action of small wheels running horizontally or at angles of 45° on the sides of the middle rail. The diameter of the truck-wheels will be nine feet. The three driving-wheels will be twenty-four feet in diameter, giving a piston speed of 1,470 feet per minute to make the three miles which Mr. Abbe expects his machine to cover in that time. "The shaft that has the two wheels," according to Mr. Abbe, "has cranks on the inside of journals, the center of pin corresponding with the center of engines. Then when engines are placed midway between the single and double drivers allows the double pair of drivers to govern the machine when running, while the single wheel, running on the center rail, is allowed an easy motion in conformity to the engines."

The engineer who manipulates rhe reverse and the cut-off for the ideal express will occupy a position of some prominence, his domicile being placed between two of the big driving-wheels and behind the third. The fireman and engineer will be widely separated, the fire-boxes being close to the ground and extending on either side of the forward driving-wheel. Thus the engineer will have to be his own lookout. The peculiar advantages of the position given to the cab are said to be the vertical control over the engine and the superior view of the track.

The engines will have cylinders 30x42 inches in diameter and the open portions of the skeleton frames will be filled in with a non-conducting substance of asbestos and plaster-of-Paris, which will retain the heat and prevent condensation in the cylinders. The boiler will be placed on the lower frame under the crank shafts. The coal bunkers are in the extreme forward end of the machine

just ahead of the fire-boxes. The weight of the boiler is evenly distributed, and by placing the heavy parts of the machine so near the rail a swinging motion is prevented when the engines are in operation.

In conclusion Mr. Abbe states that 300 pounds pressure will be necessary in the boiler. Now these important questions, he says, arise: Can such piston-speed be used? Can packing be made which will stand such friction and metal bearings which will keep cool? Can steam be made fast enough with the boiler in such a position? Can men be found to fire such a machine or run it? Will people ride at such a rate of speed? These, of course, are minor points, however, and easily overcome. The main questions have been solved in this article and rapid transit is now an assured fact. It is to be hoped that Mr. Abbe will hasten to enter into a contract with the projector of the tunnel between England and America under the Atlantic, so that his ideal express may in the hereafter be utilized, not only for trans-continental but for inter-continental travel.—*Globe-Democrat.*

STAMPED RAILWAY WHEELS.

The following account of the manufacture of railway wheels by stamping at the Blast Furnace, Forge and Steel Works, St. Chamond, is from *Revue Generale des Chemins de Fer*, and was translated in the abstracts of the British Institution of Civil Engineers: "The wheel centre is constructed in three operations—the formation of the rough piece, the rolling into shape and to the diameter, and the finishing off. The processes are a little different for working in iron and in steel. The description applies to a wheel center of the Western Railway having an undulated web of about three feet in diameter and weighing 495 pounds. A wrought-iron pile is made up of six layers of bars, eight inches by four wide, cut to a circle twenty inches in diameter, placed between two flat rings of iron, one above and one below the six layers, keeping them in and binding them. Three rings of one and one-half inch square iron, seven or eight inches in diameter, are piled upon the layers as materials for the nave. After the hammering for the first heat, the slab is inverted and three more rings are placed on the other side for the other portion of the nave, and for the second heat. With two more heats, making four heats in all and five or six blows of the hammer in each heat, the forging is completed. The central opening is punched out in the operation of stamping. For the manufacture of steel centers a very mild steel is used, having a tensile strength of from twenty-five tons to thirty tons per square inch, and an extensibility of twenty per cent. A special ingot weighs, for one of the Western wheels, 530 pounds. The work is done in two heats. The ingot is heated, in the course of an hour or an hour and a half, to a white-yellow. It is placed for hammering in the position it occupied in the mold, and any blown holes that may be present in the bloom are likely to be removed in piercing for the nave. Each hammering requires from five to ten minutes; the second heat

only requires twenty minutes. The rim and the web are rolled to form in one heat by rollers similar to those employed for rolling tires. In the same heat the center is finished under a fifteen-ton hammer. Steel centers are annealed by being raised to a cherry-red heat and cooled slowly, covered by iron plates. Centers of steel and of iron have been tested for strength by the falling of a weight of seven tons upon the nave, the center being supported horizontally at the rim. The steel center resisted without fracture 210 blows of the hammer falling from eight to eighteen inches. The nave was depressed four inches. An iron wheel broke with 150 blows on a fall of from eight to twelve inches.

WASHINGTON MONUMENT COMPLETED.

The long expected completion of the Washington Monument obelisk was accomplished on December 6th by the setting in place of a marble cap stone and its pyramidal apex of aluminum. The ceremonies were few and simple, an elaborate celebration of the event being reserved for Washington's birthday. Shortly after 2 o'clock Col. Thos. L. Casey, Government Engineer-in-charge, and his assistants, Capt. Davis, United States Army, and Bernard R. Green, civil engineer, together with Master Mechanic McLaughlin and several workmen, standing on a narrow platform built around the stopped marble roof near the summit, proceeded to set the capstone weighing 3,300 pounds, which was suspended from a quadropod of heavy joists supported by the platform and towering forty feet above them. As soon as the capstone was set, the American flag was unfurled overhead and a salute of twenty-one guns fired by a battery in the White House lot far below, the sound of cheers also came up faintly from a crowd of spectators gathered around the base of the monument, while a number of invited guests were on the 500 foot platform, and on the interior of the foot of the monument at that level spontaneously struck up "The Star Spangled Banner" and other patriotic songs. A steady downpour of rain had given place a little while previously to a brisk gale of wind which, at this elevation, was blowing about fifty-five miles an hour, and very few invited guests cared to avail themselves of the privileges of climbing the nearly perpendicular ladder from the 500 foot platform to the dizzy height of 533 feet from which three or four journalists and a half dozen other adventurers climbed and witnessed the setting of the capstone, and subsequently ascended to its pinnacle.

Meanwhile the Washington Monument Society, represented by Dr. Joseph M. Toner, Hon. Horatio King, Gen. William McKee Dunn, Dr. Daniel B. Clark, and T. L. Harvey, Secretary, held a meeting on the elevated platform at a height of eight feet, and when the artillery firing announced the setting of the capstone, adopted a resolution offered by Gen. Dunn congratulating the American people on the completion of this enduring monument of our nation's gratitude to the father of his country.

Among those present to-day at the completion of the structure was one of

the master mechanics who laid the corner-stone of this monument more than thirty-six years ago, and the old watchman of the monument who has been continuously employed in that capacity during nearly the whole intervening period. The flag over the monument floated to-day from the flagstaff-top, which is exactly 600 feet from the ground, thus displaying the American colors at the greatest height ever known in the world. The monument itself, with its height of 550 feet, far overtops every other structure of human hands. The aluminum apex of the monument is engraved with inscriptions, as follows: On one face

> "Chief Engineer and Architect, Thos. Lincoln Casey, Colonel Corps of Engineers. Assistants Geo. W. Davis, Fourteenth United States Infantry; Bernard R. Green, Civil Engineer; Master Mechanic P. H. McLaughlin."

On another:

> "Corner stone laid on the bed of the foundation July 4, 1848. The first stone at a height of 152 feet, laid August 7, 1880. Capstone set December 6, 1884."

On a third:

> "Joint commission at the setting of the capstone, Chester A. Arthur, W. W. Corcoran, and Chairman M. E. Bell, Edward Clark, John Newton, Act of August 2, 1876."

And on the fourth face the words:

> "Laus Deo."

The capstone is a cuneiform keystone four feet five and three-quarter inches on the outer faces in height, with a shoulder on each side of seven inches to tie the ashler face of the pyramidal cap; below this shoulder the stone is ten and a half inches, making the total length from top to base five feet two and a half inches. The stone at the base is three feet nineteen-seventeenth inches square, and at the cap where the aluminum tip is to be placed, the diameter is exactly five inches.

The aluminum tip is something new in monumental architecture, and its use is for two purposes. It is freer from oxidation than any other substance that could be used, and it is of exceptional value as a conductor of electricity, serving, in this case, as the tip of both monument and the lightning-rod. It will be secured in its place by a wrought copper rod, leading down through the center of the capstone, and below will connect with each of the four columns that form the elevator frame in the main shaft. At the base of the monument, these leaders will be conducted to the well beneath the center of the foundation, thus forming the most perfect electrical conductor known to science.

The capstone was set by the following means:

Beginning a few feet above the main shaft, on each of the four sides of the pyramid, four heavy joists are placed, and on these, thirty-three feet above, is built a platform extending around the cap. Extending up from this platform are four joists, one at each corner of the structure, which meet forty feet above and support a tackle with which the remaining stones are handled. To the point where the platform is built all the stones of the pyramid were handled with the mast and boom that extended from the interior framework, but as the cone narrowed, the spar was removed and the outside frame built. Before this, however, all the remaining stones were hoisted to the platform and handled from there. When the capstone is set this afternoon and the tip placed in position and fastened to the copper rods below, the upper joists will be removed and lowered by the men, and as the platform and its supporting-frame is taken away and lowered, the remaining men will work from a temporary platform hung from skids or joists projecting from the window, which has been cut in the east face of the last course below the cap. This window is three feet long and two feet wide, and after the last timber has been lowered and the last man has entered the pyramid the hole will be closed by a stone, which accurately fits, and cemented in place. The lower platform and the guard-netting at the 500-foot level will be removed through the hole at the base of the pyramid, which was left to pass the upper stones outside from the elevator. When this is done the stones belonging there will be set and the whole structure from foundation to the aluminum tip will present an unbroken appearance. The narrow windows in each face of the pyramid, which are four feet above the 500-foot landing, will be fitted with heavy marble shutters, which are to be worked by ingenious machinery inside. These windows, which seem like tiny streaks from the ground, are each three feet long and eighteen inches high, and are eight in number, two on each face, giving a perfect view of the surroundings.

The corner-stone of the monument was laid with imposing ceremonies July 4, 1848, and the work for several years was paid for with money derived from popular subscriptions. The source, however, soon failed, and after about $200,000 had been expended the work ceased, and during the years that elapsed from 1852 until 1859 the unfinished shaft (which resembled more the whitewashed chimney of a huge factory) was this nation's disgrace. Finally, on Independence day of the Centennial year, Senator Sherman presented a resolution declaring it to be the sense of Congress that the monument should be completed. The resolution and the necessary appropriation to begin the work anew was passed by both houses unanimously, and since then the work has progressed steadily.

In 1876 the monument had reached the height of 152 feet above the foundation, and about $260,000 had been expended on its construction; $900,000 has been expended under appropriations of Congress. The corner-stone, which was cut from the same ledge of marble (near Cockeyeville, Md.), from which the marble of the shaft has been taken, weighed a little more than twelve tons, and was laid at the north-east corner of the foundation.

Very soon after the appropriation of 1876 became available, Colonel (then lieutenant colonel) Thomas Lincoln Casey, corps of engineers, U. S. A., was designated by President Grant, through Secretary of War McCrary, as the engineer officer to conduct the work, and Captain George W. Davis, 14th U. S. infantry, was ordered here from Texas and placed on special duty as an acting engineer officer, as assistant for the monument construction.

The first work done was in 1877, when shafts were sunk at different points about the monolith and borings made to find the character of the strata below the foundation. It had already been ascertained that the original foundation extended only five feet below the surrounding earth surface, while fourteen feet reached above to the floor of the shaft. The examinations showed that below the old foundation was a series of layers of yellow and blue clay on a rock strata, sloping away to the original bed of the adjoining Potomac, and that these beds of clay were thickly strewn with huge boulders of the ice-period. The clay taken out was tested for compressibility, but the examinations and tests showed that, to sustain the huge structure of over 81,000 tons, the foundation should rest upon the bedrock, still fifteen feet below. These examinations and the studies of the subject made by Captain Davis continued until 1878, when finally the plan of building a new foundation beneath the old one was decided upon, to the astonishment of engineers all over the civilized world. How such a thing could be done was the wonder until Colonel Casey and Captain Davis practically demonstrated it by accomplishing the fact.

The old foundation was so ridiculously shallow and narrow in base that the addition of the weight necessary to carry out the design of height would have sunk the structure into the ground, much like thrusting a cane into moist earth, or, more likely, have toppled it over toward the adjacent Potomac flats. A new and wide foundation was built under the old one and resting on the bedrock beneath. The magnitude of this before unheard-of feat of engineering was so great that home and foreign civil engineers visited the work to see for themselves that it was actually being done. The complete work of the sub-foundation is one of the greatest feats of engineering known in the world.

Meantime, while the foundation examination had progressed, means had been found to reach and examine the top which was left unfinished before Congress took action. The three upper courses of stone, each one two feet high, were found to be so damaged by the action of frost, and perhaps lightning, that they were removed before the work on top was resumed at the exact height of 150 feet.

September 11, 1878, an inspector of the proposed work and Mr. P. H. McLaughlin reported at the monument grounds, and were followed next day by a small gang of carpenters, of which Mr. McLaughlin was then the foreman, who began the erection of the necessary buildings. The first superintendent, who reported in the same month, was Mr. Navarre, and on his resignation in 1879 Mr. McLaughlin was promoted from master carpenter to succeed him.

August 7, 1880, the first stone above 150 feet from the foundation was laid, and to this date Mr. McLaughlin has superintended the whole of the work.

Since the commencement of work on this monument the States of California, Oregon, Minnesota, Kansas, Nevada, Nebraska, and Colorado have been admitted into the Union, we have chronicled the history of nine political administrations, witnessed the birth and death of political parties, and passed through a terrible civil war and four financial strains, and established the best banking system in the world. The great republic in the meantime has grown from 23,000,000 to 55,000,000 people, and in material wealth from $7,400,000,000, or $320 per inhabitant, to $57,000,000,000, or about $1,000 per inhabitant. When the National Monument was begun Great Britain possessed five times the wealth owned by the United States, and while the wealth of the former country has only doubled within the past four decades, that of the latter has increased twelvefold. As to the constituent factors of American progress in their aggregate in the four decades they are sufficient to buy up the whole Austrian Empire several times over, or pay for the aggregate value of the "effete" monarchies of Italy, Holland, and Belgium almost three times over during that period. Our tilled acreage has increased from 50,000,000 to 170,000,000 acres, the crops have increased in value from $415,000,000 to $2,500,000,000, and the cattle have increased in value from $380,000,000 to $18,400,000,000. Our imports have increased from $178,000,000 to $668,000.000, and our exports from $152,000,000 to $836,000,000.

The work is by no means completed now, for it will take many months, and perhaps several years, to complete the pedestal and finish up the surroundings.

The joint commission in charge of the monument has recently submitted to Congress a report showing its progress during the past year. The report shows the weight of the monument is 81,120 tons, and it has cost $1,187,710, of which Congress appropriated $887,710. In relation to the completion of the monument the engineer in charge of the work submitted a report with that of the commission. He says: "Two methods of treating the terrace at the foot of the shaft have been suggested. One method proposes to erect a retaining wall of the most beautiful marble around the terrace, which wall is to be surmounted with marble balustrade. At the centre of each face is to be set off, broad double stairs extending from the general level of the esplanade, which is to be paved with marble tiles of approved patterns. The other method of finish proposed, is to fill earth about the present terrace, and extend this filling as far from the monument as to fade the slopes of the embankment gradually into the surrounding surfaces, and this is to be done with so much skill as to give the mound an appearance as far from artificial as possible. This mound is then to be planted with trees and shrubs, and paths are to be laid out. A pavement is to be put around the foot of the mound, far enough to prevent storm waters from washing out the filling. If the marble wall is decided upon, an appropriation of $612,300 is asked to complete the entire work. If the second proposition is adopted but $166,800 is desired. The joint commission favor the latter method.

The Congressional Commission to arrange for the dedication of the monu-

ment invites through the medium of the Associated Press all civil, military and naval organizations in the United States to attend the ceremonies, which will be held at the base of the monument on the 21st of February, 1885. Any organization accepting this invitation is requested to notify Lieutenant-General P. H. Sheridan, U. S. A., Marshal of the day, of the number of persons in such organization, whereupon he will assign it to proper position in the procession to be provided for by the commission. At a meeting of the commission recently the programme was decided upon. The morning is to be devoted by the Marshal of the day to the concentration of societies and troops on the ground. The ceremonies at the monument will begin precisely at 12 o'clock, Senator John Sherman, Chairman of the Congressional Commission, presiding. The programme will be as follows:

Music. Prayer by Rev. Mr. Sutor, of Christ Church, Alexandria, Va. Remarks by W. W. Corcoran, First Vice-President of the Washington Monument Society. Remarks by the engineers of the joint commission turning over the completed structure to the President of the United States. Acceptance by the President for the people of the United States and dedication to the memory of General George Washington. Music.

During the performance of music the procession will be formed and will proceed to the Capitol Grounds where it will be reviewed by the President of the United States.

The order of procession will be as follows:

Chief Marshal, with Chief of Staff and an aide from every State and Territory; military escort; General commanding; brigade of artillery; brigade of infantry; naval brigade; battalion of marines; chartered military organizations, taking precedence by the dates of their charters, and temporarily organized in regiments and brigades; civic procession; Congressional Commission; members and ex-members of the joint commission for the completion of the monument; engineers of the monuement and detail of workmen; the Washington Monument Society; the President of the United States and orator of the day; the President and Vice-President elect of the United States; ex-Presidents of the United States; Judges of the Supreme Court; Diplomatic Corps; Governors of States and their respective staffs, taking precedence in the order of admission of their States into the Union; Senate and House of Representatives; Commissioners of the District of Columbia; Society of the Cincinnati; Masonic fraterntty, with other organizations which officially contributed stores or money for the erection of the monument; citizens of States and Territories, with civic organizations from those States without partisan flags or emblems, each State taking precedence in order of admission into the Union; Fire Department of the District of Columbia and visiting firemen.

BOTANY.

VEGETABLE DISSEMINATION.

REV. L. J. TEMPLIN.

Whoever looks into the vegetable world for the first time with an intelligent eye and a thoughtful and inquiring mind will be forcibly struck with the manifestations of design that meet him on every hand. The wise adaptation of means to ends and the beautiful harmony that appears in all departments of organic nature naturally lead the unbiased mind to the inference that, behind and beneath all this order and harmony, originating, upholding and directing them, there is, and of necessity must be, an all comprehending intelligent power. Probably in all the realm of organic nature there is no more manifest exhibition of wise adaptation of means to the accomplishment of worthy purposes than is seen in the various methods employed for the dispersion and dissemination of the different species of plants. This field of research furnishes so many evidences of design, and so much of variety and excellence that it seems difficult if not impossible to shut out the conviction that some intelligent designer must have been employed in planning a scheme that has so many excellences to commend it to the enlightened judgment. To attribute all this to chance is to invest chance with the attributes and acts of the Deity, and simply changes the name of this great first cause. But in the sense in which this term is generally used the assumption is absurd, as, in that sense chance is nothing and consequently can do nothing. Turning our attention to the subject of the dissemination of plants, we find Nature employing various methods that are not confined to any particular order or class of plants. Considering a plant in its relation to the world at large as well as to its own species, its whole purpose in life seems to be to propagate its own species, and disseminate its progeny as extensively as possible under its surrounding conditions. The spreading of plants from the original locality is accomplished not only in a great variety of ways, but also with a great diversity of degrees of rapidity.

The method by which the offspring is carried the least distance from the parent plant, and, consequently, in which the dissemination is the slowest, seems to find illustrations in those cases in which the young plant starts as a sucker or offshoot directly from the base or collar of the parent plant. In this process adventitious buds are formed at or just beneath the surface of the ground which push up new stems into the air, and from the subterranean parts of these, new roots are sent out into the soil, thus enabling the young plant to draw its nourishment from soil and air independently of the parent plant and even to survive

the death and decay of that parent notwithstanding the vital union that previously existed between them. These in turn form buds and send up suckers, thus further extending the group till joining with other similar groups an extensive break or forest is formed.

Examples of this are exceedingly numerous. This mode is often illustrated by the peach, apple and basswood among trees; the elder, currant and gooseberry among shrubs, and the balm, rhubarb and various grasses among herbaceous plants. A similar or identical principle is involved in those cases in which not only the parts about the base of the plant, but all parts of the roots, even to their extremities, form buds and send up suckers, thus extending the area occupied by the plant much more rapidly than in the preceding case. Of this method the wild plum, murello cherry, and the blackberry and red-raspberry are well known examples. Resembling this method in appearance is the multiplication of plants and the consequent growth of them a short space from the parent plant, is that by means of the rhizoma or underground stem. Some plants send out these stems laterly at a greater or less depth below the surface of the ground. At frequent intervals, greater or less according to the species of plant, a node is formed from which roots are emitted and a stem is sent up to the surface where it forms a perfect, and, to all appearances, an independent plant. Not only does this rhizoma continue to extend, sending up its numerous stems, but from each of its nodes similar stems branch off, usually on both sides, which repeat the same phenomena as the original one. In this way these stems and plants are multiplied till the whole space occupied by this multiple plant becomes a regular net-work of stems and the plants become so crowded as to smother the later comers that are struggling to reach the light and air. A single plant of this nature will, in a comparatively short time, occupy all the ground for a considerable distance in all directions from the original plant. And if it be a perennial, this process will continue from year to year, and there is really no limit to its extension except such as may be presented by insurmountable obstacles that may bar its further progress. As examples of this mode of propagation and dispersion may be mentioned the Canada-thistle, Chufa, Bermuda-grass and couch or quitch-grass.

Tubers, as of the potato and artichoke, are only enlarged underground stems, full of buds that we call eyes. From them the plants of the next season are produced a little distance from the stalk of the parent plant, and so the young plants are gradually separated and dispersed. Similar in nature and manner of growth to the underground creeping plants are those that send their creeping stems on the surface of the soil, sending roots into the soil and stems into the air, and also other creeping stems in lateral directions on the surface. Of this class may be named the twin-flower, the partridge-berry, some species of mint and some of the creeping grasses.

Differing but little from this is the regular running plant that sends out a slender stem that grows to some length without node or leaf; a cluster of leaves is then formed, from the base of which roots enter the ground and thus a complete

plant is formed, while the runner continues its course forming other similar plants as it progresses.

The best illustrations of this mode of dissemination are the strawberry and the cinquefoil. Rising still higher, we find plants with an upright mode of growth, that bend over till their tips come in contact with the soil where they take root and form new plants. In this manner the species travels, making a few feet of progress each year. The hobble-bush and black raspberry are good examples of this mode.

Many trees and plants, when their branches are brought into contact, with moist soil, will take root and produce new plants at a considerable distance from the one to which they are attached. The grape and gooseberry are familiar examples; but nearly all kinds of vegetation will do likewise if the conditions are exactly favorable. Still another method of extending certain vegetable forms is by means of aërial roots that descend from the branches till they come in contact with the soil, which they enter and divide as other roots. The circulation is then reversed and the portion above ground becomes a true stem. The stems continuing to elongate, this process is repeated on all sides till a single tree with its multitude of trunks becomes a forest capable of sheltering an army of men. The Banian tree is the most noted illustration of this. A single tree of this species is known to cover a whole island of considerable extent.

So far we have considered the dispersion of plants only in cases where the young plant remains attached to its parent till it has taken root and become established and capable of existing as an independent plant, but in none of these cases could the offspring start in life at any great distance from the parent plant, from which it proceeded and of which for a time it formed a part, consequently their progress was but slow; at most amounting to but a few feet in a year, and in many cases requiring many years to advance but a very few feet.

But it is evident that it would have required interminable ages to extend any forms of vegetable life, from any center of dispersion, to the different parts of the earth by any of these methods.

Nature has therefore provided for the general dissemination, reproduction and perpetuation of the various species of vegetable forms through the agency of seeds. Seeds are embryonic plants, in which the germ of the future plant, accompanied by a sufficiency of plant-food to sustain it till it becomes able to secure its own nutriment from the soil and air, is wrapped in peculiar cerements and generally enclosed in a leathery, horny or woody covering or shell. These seeds may be carried "to earth's remotest bounds," and preserved for years, and in some cases probably for ages, and then, when placed under favorable conditions, germinate and grow, producing in all essentials an exact counterpart of the plant by which the seed was produced.

The various means to be employed for the dissemination of seeds so as to scatter as far and wide as possible the plants of different species, seems—I speak it reverently—to have received the most careful attention of the Author of nature.

Many seeds and nuts are not provided with any means to aid in their distribution, but this is often accomplished in some degree by the spread of the branches causing them to fall at a little distance from the root of the plant producing them. Nuts and acorns in falling frequently strike on branches and bound or glance off to a distance of some rods. And in falling to the ground they frequently strike on sticks, etc., and bound to a considerable distance, and should it be on a hillside, they may go several rods before stopping.

Many plants and shrubs grow in a leaning or inclined position as if on purpose to reach out and drop their seeds as far as possible from their own roots.

Many grow entirely prostrate, sending out their stems on the surface of the ground, apparently for the same purpose. Scores of plants might be named in illustration of this fact. Some plants have their seed carpels so arranged as to give the appearance of having been made specially to retain instead of disperse the seeds they contain. Poppy, jimson, mullein and many others have the opening at the top as if to prevent the seeds from falling out. But in this we see a wise provision for the scattering of the seed, for if the openings were at the bottom instead of the top the seed as soon as ripe would all fall out around the stalk on which they grew making it impossible to thrive; but as arranged the seed can be thrown out only as the plant is shaken by the wind or other means, and so is scattered around to a considerable distance. The wind is thus seen to become an agent in the dispersion of seeds. The seeds of some trees are furnished with wings (samara) to enable them to float or sail on the air or be carried by the wind as they fall, so they reach the ground some distance from the trees on which they grew. Maple, ash, elm, tulip-tree, linden or basswood, and pine are thus furnished with winged seed. It is worthy of notice that all these are trees that grow to a considerable height so the seeds may sail to a good distance before reaching the ground.

In this connection notice may be taken of the honey-locust and coffee-tree, whose seeds grow in a broad, flat pod, generally with a spiral twist that sometimes causes them to sail off several rods from the parent tree. Every one is acquainted with different kinds of plants that have attached to their seed a tuft of woolly or hairy pappus or down by which they are carried long distances by the wind. It is impossible to assign any limits to the journeys some of these seeds with their buoyant attachments will sometimes travel. Some claim, and with reason, that during long continued storms they may be carried across the ocean and fall on distant continents.

Thistle, dandelion, fire or butter-weed, are well known examples. The seeds of the cottonwood (poplar) are enveloped in a cottony down that causes them to float about and scatter to great distances over the country. He that cannot see adaptation and design in all these arrangments is blind indeed. Other plants, instead of furnishing their seeds with wings and down to fly with and travel from place to place themselves, scatter their seeds by the way. Two or three species of plants grow in this prairie country, that when grown form large bunches and when broken off by the wind they go rolling and tumbling over

the fields and prairies as driven by the wind, veritable "tumbling-weeds," scattering not only their seeds, but often those of other plants that have become entangled in them. The rose of Jericho (Anastatica) that grows in the arid deserts of both Africa and Asia, when mature, rolls up in a ball, becomes detached from the ground and goes rolling before the wind till it reaches a moist spot, or there falls a slight sprinkling of rain, when it immediately unrolls, the pods open and the seeds fall out and germinate within eighteen hours, so that by the time the transient moisture has disappeared the young plant has taken root and is ready to grow in spite of the scorching sun and blasting winds of the desert. While a few plants thus travel and sow their own seeds, others stay at home and throw them so as to scatter them to various distances. Some geraniums when the pod bursts throw their seeds out by a little spring that is arranged in it for that purpose.

In the pods of beans the fiber is arranged at an oblique angle with the linear direction of the pod and when it becomes dry and bursts, this arrangment of the fiber causes the two halves of the pod to suddenly twist spirally, by which motion the seeds are thrown out to some distance. The castor-oil bean also has the habit of throwing its seeds out by a sudden springing of the material of the pod Almost every one has noticed how the parts of the pod of the touch-me-not (im patiens) will curl up with a sudden spring and scatter the seeds in all directions on being touched or shaken. The wild touch-me-not, or jewel-weed, acts in the same manner but with even still greater energy. In cyclanthera, the fruit of which is not symmetrical, one side being flat and the other round, when ripe suddenly explodes scattering its seeds on all sides.

In arcentholium, a relative of the mistletoe, and a parasite of the juniper, the seeds are thrown from one tree to another. The squirting cucumber, a well known plant of southern Europe, as it approaches maturity, becomes so gorged with fluid that when fully ripe it bursts near the place of attachment to the stem and throws its contents to a distance of several yards. The discharge is accompanied by a report as of a toy pistol. Persons venturing to touch one, or even passing near them are liable to be greeted with the contents of this vegetable pop-gun. Many other plants that project their seeds might be named, but these are sufficient for our purpose. Water is also an agent in the dispersion and dissemination of seeds. During heavy rains and floods nearly all kinds of seeds are liable to be carried down from the higher ground into the rivers and by them transported long distances. These eventually find a resting place in the sediment of some island, or low bottom land, and spring up and flourish luxuriantly. The currents of the ocean also become the means of transport for seeds that are adapted to floating. The cocoanut, whose corky shell so well adapts it to this mode of conveyance, has thus been carried to all the islands of the tropics.

In many cases animals are agents in the dispersion of the seeds of plants. Numerous species of trees and plants bear edible seeds and nuts that are gathered by various animals and birds as winter stores, some of which are lost or forgotten and so are left to grow the following year. Many kinds of fruit are eaten by

birds and animals and the seeds either dropped or, being indigestible, are voided with their droppings and spring up and grow, often at long distances from where they originated.

The seeds of a large number of plants are furnished on their outer surface with barbs or hooks by which they adhere to the coats of animals and are thus carried and scattered far and wide over the range of such animals. Some of these barbs and hooks are quite small as in the burdock, sand-bur, beggar-lice, Spanish-needle, etc. But in a few cases they are large and appear quite formidable. The seed pod of the common martynia of our gardens, when dry will sometimes fasten its long curved claws in the skin of an animal, when it is with difficulty that it can rid itself of this terrible "devil's claw."

But the most formidable production of this kind, probably, in the world is a product of South Africa called by botanists, Harpagophyton procumbens. The seeds of this plant are numerously branched, the branches being near an inch long and having numerous stout, sharp, recurved prickles. When once fastened on an animal it is exceedingly difficult to remove. It is said that lions sometimes in trying to remove it from their feet after stepping on it, get it fastened in their mouths and finding it impossible to remove it die a most miserable death.

And here we take leave of our subject, though numberless other examples might be given to illustrate the beautiful adaptation of means to the purpose of covering the globe with the various vegetable productions of the earth. In the presence of such wisdom and goodness let up learn humility and reverence.

Cañon City, Colorado, December, 1884.

PHILOSOPHY.

RELIGION AND THE DOCTRINE OF EVOLUTION.[1]

FREDERICK TEMPLE, D. D., BISHOP OF EXETER.

The regularity of nature is the first postulate of Science; but it requires the very slightest observation to show us that, along with this regularity, there exists a vast irregularity, which Science can only deal with by exclusion from its province. The world as we see it is full of changes; and these changes, when patiently and perseveringly examined, are found to be subject to invariable, or almost invariable, laws. But the things themselves which thus change are as multifarious as the changes which they undergo. They vary infinitely in quantity, in qualities, in arrangement throughout space, possibly in arrangement throughout time. Take a single substance such, say, as gold. How much gold

1 Abstracted from "The Relations between Religion and Science," by the Lord Bishop of Exeter.

there is in the whole universe, and where it is situated, we not only have no knowledge, but can hardly be said to be on the way to have knowledge. Why its qualities are what they are, and why it alone possesses all these qualities; how long it has existed, and how long it will continue to exist, these questions we are unable to answer. The existence of the many forms of matter, the properties of each form, the distribution of each: all this Science must in the last resort assume.

But I say in the last resort. For it is possible, and Science soon makes it evident that it is true, that some forms of matter grow out of other forms. There are endless combinations. And the growth of new out of old forms is of necessity a sequence, and falls under the law of invariability of sequences, and becomes the subject-matter of science. As in each separate case Science asserts each event of to-day to have followed by a law of invariable sequence on the events of yesterday; the earth has reached the precise point in its orbit now which was determined by the law of gravitation as applied to its motion at the point which it reached a moment ago; the weather of the present hour has come by meteorological laws out of the weather of the last hour; the crops and the flocks now found on the surface of the habitable earth are the necessary outcome of preceding harvests and preceding flocks, and of all that has been done to maintain and increase them; so, too, if we look at the universe as a whole, the present condition of that whole is, if the scientific postulate of invariable sequence be admitted, and in as far as it is admitted, the necessary outcome of its former condition; and all the various forms of matter, whether living or inanimate, must, for the same reason and with the same limitation, be the necessary outcome of preceding forms of matter. This is the foundation of the doctrine of evolution.

Now, stated in this abstract form, this doctrine will be, and indeed if science be admitted at all must be, accepted by everybody. Even the Roman Church, which holds that God is perpetually interfering with the course of nature, either in the interests of religious truth or out of loving kindness to his creatures, yet will acknowledge that the number of such interferences almost disappears in comparison of the countless millions of instances in which there is no reason to believe in any interference at all. And, if we look at the universe as a whole, the general proposition as stated above is quite unaffected by the infinitesimal exception which is to be made by a believer in frequent miracles. But when this proposition is applied in detail it at once introduces the possibility of an entirely new history of the material universe. For this universe, as we see it, is almost entirely made up of composite and not of simple substances. We have been able to analyze all the substances that we know into a comparatively small number of simple elements—some usually solid, some liquid, some gaseous. But these simple elements are rarely found uncombined with others; most of those which we meet with in a pure state have been taken out of combination and reduced to simplicity by human agency. The various metals that we ordinarily use are mostly found in a state of ore, and we do not generally obtain them pure except

by smelting. The air we breathe, though not a compound, is a mixture. The water which is essential to our life is a compound. And, if we pass from inorganic to organic substances, all vegetables and animals are compound, sustained by various articles of food which go to make up their frames. Now, how have these compounds been formed? It is quite possible that some of them, or all of them to some extent, may have been formed from the first. If Science could go back to the beginning of all things, which it obviously can not, it might find the composition already accomplished, and be compelled to start with it as a given fact—a fact as incapable of scientific explanation as the existence of matter at all. But, on the other hand, composition and decomposition is a matter of every-day experience. Our very food could not nourish us except by passing through these processes in our bodies; and by the same processes we prepare much of our food before consuming it. May not Science go back to the time when these processes had not yet begun? May not the starting-point of the history of the universe be a condition in which the simple elements were still uncombined? If Science could go back to the beginning of all things, might we not find all the elements of material things ready indeed for the action of the inherent forces which would presently unite them in an infinite variety of combinations, but as yet still separate from each other? Scattered through enormous regions of space, but drawn together by the force of gravitation; their original heat, whatever it may have been, increased by their mutual collision; made to act chemically on one another by such increase or by subsequent decrease of temperature; perpetually approaching nearer to the forms into which, by the incessant action of the same forces, the present universe has grown—these elements, and the working of the several laws of their own proper nature, may be enough to account scientifically for all the phenomena that we observe. We do not even then get back to regularity. Why these elements, and no others; why in these precise quantities; why so distributed in space; why endowed with these properties: still are questions which Science can not answer, and there seems no reason to expect that any scientific answer will ever be possible. Nay, I know not whether it may not be asserted that the impossibility of answering one at least among these questions is capable of demonstration. For the whole system of things, as far as we know it, depends on the perpetual rotation of the heavenly bodies; and without original irregularity in the distribution of matter no motion of rotation could ever have spontaneously arisen. And, if this irregularity be thus original, Science can give no account of it. Science, therefore, will have to begin with assuming certain facts for which it can never hope to account. But it *may* begin by assuming that, speaking roughly, the universe was always very much what we see it now, and that composition and decomposition have always nearly balanced each other, and that there have been from the beginning the same sun and moon and planets and stars in the sky, the same animals on the earth and in the seas, the same vegetation, the same minerals; and that though there have been incessant changes, and possibly all these changes in one general direction, yet these changes have never amounted to what would furnish a scientific explanation of the form

which matter has assumed. Or, on the other hand, Science *may* assert the possibility of going back to a far earlier condition of our material system; may assert that all the forms of matter have grown up under the action of laws and forces still at work; may take as the initial state of our universe one or many enormous clouds of gaseous matter, and endeavor to trace with more or less exactness how these gradually formed themselves into what we see. Science has lately leaned to the latter alternative. To a believer the alternative may be stated thus: We all distinguish between the original creation of the material world and the history of it ever since. And we have, nay all men have, been accustomed to assign to the original creation a great deal that Science is now disposed to assign to the history. But the distinction between the original creation and the subsequent history would still remain, and forever remain, although the portion assigned to the one may be less, and that assigned to the other larger, than was formerly supposed. However far back Science may be able to push its beginning there still must be behind that beginning the original act of creation—creation not of matter only, but of the various kinds of matter, and of the laws governing all and each of those kinds, and of the distribution of this matter in space.

This application of the abstract doctrine of evolution gives it an enormous and startling expansion—so enormous and so startling that the doctrine itself seems absolutely new. To say that the present grows by regular law out of the past is one thing; to say that it has grown out of a distant past in which as yet the present forms of life upon the earth, the present vegetation, the seas and islands and continents, the very planet itself, the sun and moon, were not yet made—and all this also by regular law—that is quite another thing. And the bearings of this new application of science deserve study.

Now, it seems quite plain that this doctrine of evolution is in no sense whatever antagonistic to the teachings of religion, though it may be, and that we shall have to consider afterward, to the teachings of revelation. Why, then, should religious men, independently of its relation to revelation, shrink from it, as very many unquestionably do? The reason is that, while this doctrine leaves the truth of the existence and supremacy of God exactly where it was, it cuts away, or appears to cut away, some of the main arguments for that truth.

Now, in regard to the arguments whereby we have been accustomed to prove or to corroborate the existence of a Supreme Being, it is plain that, to take these arguments away, or to make it impossible to use them, is not to disprove or take away the truth itself. We find every day instances of men resting their faith in a truth on some grounds which we know to be untenable, and we see what a terrible trial it sometimes is when they find out that this is so, and know not as yet on what other ground they are to take their stand. And some men succumb in the trial, and lose their faith, together with the argument which has hitherto supported it. But the truth still stands, in spite of the failure of some

to keep their belief in it, and in spite of the impossibility of supporting it by the old arguments.

And, when men have become accustomed to rest their belief on new grounds, the loss of the old arguments is never found to be a very serious matter. Belief in revelation has been shaken again and again by this very increase of knowledge. It was unquestionably a dreadful blow to many in the days of Galileo to find that the language of the Bible in regard to the movement of the earth and sun was not scientifically correct. It was a dreadful blow to many in the days of the Reformation to find that they had been misled by what they believed to be an infallible Church.

Such shocks to faith try the mettle of men's moral and spiritual convictions, and they often refuse altogether to hold what they can no longer establish by the arguments which have hitherto been to them the decisive, perhaps the sole decisive, proofs.

And yet, in spite of these shocks, belief in revelation is strong still in men's souls, and is clearly not yet going to quit the world.

But let us go on to consider how far it is true that the arguments which have hitherto been regarded as proving the existence of a Supreme Creator are really affected very gravely by this doctrine of evolution.

The main argument, which at first appears to be thus set aside, is that which is founded on the marks of design, and which is worked out in his own way with marvelous skill by Paley in his "Natural Theology." Paley's argument rests, as is well known, on the evidence of design in created things, and these evidences he chiefly finds in the framework of organized living creatures. He traces with much most interesting detail the many marvelous contrivances by which animals of various kinds are adapted to the circumstances in which they are to live, the mechanism which enables them to obtain their food, to preserve their species, to escape their enemies, to remove discomforts. All nature, thus examined, and particularly all animated nature, seems full of means toward ends, and those ends invariably such as a beneficent Creator might well be supposed to have in view. And while there is undeniably one great objection to his whole argument, namely, that the Creator is represented as an artificer rather than a Creator, as overcoming difficulties which stood in his way rather than as an Almighty Being fashioning things according to his will, yet the argument thus drawn from evidence of design remains exceedingly powerful, and it has always been considered a strong corroboration of the voice within which bids us believe in a God. Now, it certainly seems at first as if this argument were altogether destroyed. If animals were not made as we see them, but evolved by natural law, still more if it appear that their wonderful adaptation to their surroundings is due to the influence of those surroundings, it might seem as if we could no longer speak of design as exhibited in their various organs; the organs, we might say, grow of themselves, some suitable and some unsuitable to the life of the creatures to which they belonged, and the unsuitable have perished and the suitable have survived.

But Paley has supplied the clew to the answer. In his well-known illustra-

tion of the watch picked up on the heath by the passing traveler, he points out that the evidence of design is certainly not lessened if it be found that the watch was so constructed that, in course of time, it produced another watch like itself. He was thinking not of evolution, but of the ordinary production of each generation of animals from the preceding. But his answer can be pushed a step further, and we may with equal justice remark that we should certainly not believe it a proof that the watch had come into existence without design if we found that it produced in course of time not merely another watch but a better. It would become more marvelous than ever if we found provision thus made, not merely for the continuance of the species, but for the perpetual improvement of the species. It is essential to animal life that the animal should be adapted to its circumstances; if, besides provision for such adaptation in each generation, we find provision for still better adaptation in future generations, how can it be said that the evidences of design are diminished? Or take any separate organ, such as the eye. It is impossible not to believe, until it be disproved, that the eye was intended to see with. We cannot say that light was made for the eye, because light subserves many other purposes besides that of enabling eyes to see. But that the eye was intended for light there is so strong a presumption that it cannot easily be rebutted. If, indeed, it could be shown that eyes fulfilled several other functions, or that species of animals which always lived in the dark still had fully-formed eyes, then we might say that the connection between the eye of the animal and the light of heaven was accidental. But the contrary is notoriously the case—so much the case that some philosophers have maintained that the eye was formed by the need for seeing, a statement which I need take no trouble to refute, just as those who make it take no trouble to establish, I will not say its truth, but even its possibility. But the fact, if it be a fact, that the eye was not originally as well adapted to see with as it is now, and that the power of perceiving light and of things in the light grew by degrees, does not show, nor even tend to show, that the eye was not intended for seeing with.

The fact is that the doctrine of evolution does not affect the substance of Paley's argument at all. The marks of design which he has pointed out remain marks of design still, even if we accept the doctrine of evolution to the full. What is touched by this doctrine is not the evidence of design but the mode in which the design was executed. Paley, no doubt, wrote on the supposition (and at that time it was hardly possible to admit any other supposition) that we must take animals to have come into existence very nearly such as we now know them: and his language, on the whole, was adapted to that supposition. But the language would rather need supplementing than changing to make it applicable to the supposition that animals were formed by evolution. In the one case the execution follows the design by the effect of a direct act of creation; in the other case the design is worked out by a slow process. In the one case the Creator made the animals at once such as they now are; in the other case he impressed on certain particles of matter, which, either at the beginning or at some point in the history of his creation, he endowed with life, such inher-

ent powers that in the ordinary course of time living creatures such as the present were developed. The creative power remains the same in either case; the design with which that creative power was exercised remains the same. He did not make the things, we may say; no, but he made them make themselves. And surely this rather adds than draws force from the great argument. It seems in itself something more majestic, something more befitting him to whom a thousand years are as one day and one day as a thousand years, thus to impress his will once for all on his creation, and provide for all its countless variety by this one original impress, than by special acts of creation to be perpetually modifying what he had previously made. It has often been objected to Paley's argument, as I remarked before, that it represents the Almighty rather as an artificer than a creator, a workman dealing with somewhat intractable materials and showing marvelous skill in overcoming difficulties rather than a beneficent Being making all things in accordance with the purposes of his love. But this objection disappears when we put the argument into the shape which the doctrine of evolution demands, and look on the Almighty as creating the original elements of matter, determining their number and their properties, creating the law of gravitation whereby as seems probable the worlds have been formed, creating the various laws of chemical and physical action, by which inorganic substances have been combined, creating above all the law of life, the mysterious law, which plainly contains such wonderful possibilities within itself, and thus providing for the ultimate development of all the many wonders of nature.

What conception of foresight and purpose can rise above that which imagines all history gathered as it were into one original creative act from which the infinite variety of the universe has come and more is coming even yet?

And yet again, it is a common objection to Paley's and similar arguments that, in spite of all the tokens of intelligence and beneficence in the creation, there is so much of the contrary character. How much there is of apparently needless pain and waste! And John Stuart Mill has urged that either we must suppose the Creator wanting in omnipotence or wanting in kindness to have left his creation so imperfect. The answer usually given is that our knowledge is partial, and, could we see the whole, the objection would probably disappear. But what force and clearness are given to this answer by the doctrine of evolution, which tells us that we are looking at a work which is not yet finished, and that the imperfections are a necessary part of a large design the general outliness of which we may already trace out, the ultimate issue of which, with all its details, is still beyond our perception! The imperfections are like the imperfections of a half-completed picture not yet ready to be seen; they are like the bud which will presently be a beautiful flower, or the larva of a beautiful and gorgeous insect; they are like the imperfections in the moral character of a saint who nevertheless is changing from glory to glory.

To the many partial designs which Paley's "Natural Theology" points out, and which still remain what they were, the doctrine of evolution adds the design of a perpetual progress. Things are so arranged that animals are perpetually

better adapted to the life they have to live. The very phrase which we commonly use to sum up Darwin's teaching, the survival of the fittest, implies a perpetual diminution of pain and increase of enjoyment for all creatures that can feel. If they are fitter for their surroundings, most certainly they will find life easier to live. And, as if to mark still more plainly the beneficence of the whole work, the less developed creatures, as we have every reason to believe, are less sensible of pain and pleasure; so that enjoyment appears to grow with the capacity for enjoyment, and suffering diminishes as sensitivity to suffering increases. And there can be no doubt that this is in many ways the tendency of nature. Beasts of prey are diminishing; life is easier for man and easier for all animals that are under his care: many species of animals perish as man fills and subjugates the globe, but those that remain have far greater happiness in their lives. In fact, all the purposes which Paley traces in the formation of living creatures are not only fulfilled by what the Creator has done, but are better fulfilled from age to age. And, though the progress may be exceedingly slow, the nature of the progress cannot be mistaken.

If the "Natural Theology" were now to be written, the stress of the argument would be put on a different place. Instead of insisting wholly or mainly on the wonderful adaptation of means to ends in the structure of living animals and plants, we should look rather to the original properties impressed on matter from the beginning, and on the beneficent consequences that have flowed from those properties. We should dwell on the peculiar properties that must be inherent in the molecules of the original elements to cause such results to follow from their action and re-action on one another. We should dwell on the part played in the universe by the properties of oxygen, the great purifier, and one of the great heat-givers; of carbon, the chief light-giver and heat-giver; of water, the great solvent and the store-house of heat; of the atmosphere and the vapors in it, the protector of the earth which it surrounds. We should trace the beneficent effects of pain and pleasure in their subservience to the purification of life. The marks of a purpose impressed from the first on all creation would be even more visible than ever before.

And we could not overlook the beauty of nature and of all created things as part of that purpose, coming in many cases out of that very survival of the fittest of which Darwin has spoken, and yet a distinct object in itself. For this beauty there is no need in the economy of Nature whatever. The beauty of the starry heavens, which so impressed the mind of Kant that he put it by the side of the moral law as proving the existence of a Creator, is not wanted either for the evolution of the world or for the preservation of living creatures. Our enjoyment of it is a super-added gift certainly not necessary for the existence or the continuance of our species. The beauty of flowers, according to the teaching of the doctrine of evolution, has generally grown out of the need which makes it good for plants to attract insects. The insects carry the pollen from flower to to flower, and thus, as it were mix the breed; and this produces the stronger plants which outlive the competition of the rest. The plants, therefore, which are most

conspicuous gain an advantage by attracting insects most. That successive generations of flowers should thus show brighter and brighter colors is intelligible. But the beauty of flowers is far more than mere conspicuousness of colors, even though that be the main ingredient. Why should the wonderful grace, and delicacy, and harmony of tint be added? Is all this mere chance? Is all this superfluity pervading the whole world and perpetually supplying to the highest of living creatures, and that, too, in a real proportion to his superiority, the most refined and elevating of pleasures, an accident without any purpose at all? If evolution has produced the world such as we see and all its endless beauty, it has bestowed on our own dwelling-place in lavish abundance and in marvelous perfection that on which men spend their substance without stint, that which they value above all but downright necessities, that which they admire beyond all except the law of duty itself. We cannot think that this is not designed, nor that the Artist who produced it was blind to what was coming out of his work.

Once more, the doctrine of evolution restores to the science of nature the unity which we should expect in the creation of God. Paley's argument proved design, but included the possibility of many designers. Not one design, but many separate designs, all no doubt of the same character, but all worked out independently of one another, is the picture that he puts before us. But the doctrine of evolution binds all existing things on earth into one. Every mineral, every plant, every animal has such properties that it benefits other things besides itself, and derives benefit in turn. The insect develops the plant, and the plant the insect; the brute aids in the evolution of the man, and the man in that of the brute. All things are embraced in one great design, beginning with the very creation. He who uses the doctrine of evolution to prove that no intelligence planned the world, is undertaking the self-contradictory task of showing that a great machine has no purpose by tracing in detail the marvelous complexity of its parts, and the still more marvelous precision with which all work together to produce a common result.

To conclude, the doctrine of evolution leaves the argument for an intelligent Creator and Governor of the world stronger than it was before. There is still as much as ever the proof of an intelligent purpose pervading all creation. The difference is, that the execution of that purpose belongs more to the original act of creation, less to acts of government since. There is more divine foresight, there is less divine interposition; and whatever has been taken from the latter has been added to the former.

Some scientific students of nature may fancy they can deduce in the working out of the theory results inconsistent with religious belief; and in a future lecture these will have to be examined; and it is possible that the theory may be so presented as to be inconsistent with the teaching of revelation. But, whatever may be the relation of the doctrine of evolution to revelation, it cannot be said that this doctrine is antagonistic to religion in its essence. The progress of science in this direction will assuredly end in helping men to believe with more assurance than ever that the Lord by wisdom hath founded the earth, by understanding hath he established the heavens.—*Popular Science Monthly.*

ON RAPID CHANGES IN THE HISTORY OF SPECIES.

Mr. Thomas Meehan exhibited flowers of the remarkable *Halesia* noted at page 32, and remarked on the wide divergence reached without any intervening modifications from the original, and observed that it was another illustration of what he thought must now be generally accepted, that the maxim of Ray "*Natura non facit saltum*" itself needed modification. He had called attention to this particular departure, among others, in a paper before the *American Association for the Advancement of Science*, in 1874;[1] what he desired to do now was to emphasize a few of the points brought out prominently in that paper, that "Variations in species as in morphological changes in individuals, are by no means by gradual modifications; that suddenly formed and marked variations perpetuate themselves from seeds, and behave in all respects as acknowledged species; and that variations of similar characters would appear at times in widely separated localities."

In addition to the illustrations given in that paper, a remarkable one was afforded by the *Richardia æthiopica*, the common "calla" of gardens, the present season. Some four inches below the perfect flower a mere spathe was developed, partially green, but mostly white, as usual, but in this case we do not call it a spathe, but a huge bract. In other words, the usually naked flower-scape of the *Richardia* had borne a bract. Flowers with a pair of more or less imperfect spathes were not uncommon in some seasons; the peculiarity of the present season was the interval of several inches on the stem, which justified the term of bract to the lower spathe. From the vicinity of Philadelphia numbers had been brought to him, and others had been sent from Ohio, Indiana and Illinois—some hundreds of miles apart. What was the peculiarity in this season over others which induced the production of this bract, was one question. Whatever it may have been, it operated in bringing about a change of character, without the intervention of seed, directly on the plant, and in many widely separated places at the same time. What is to prevent a law which operates exceptionally in one season, operating again and in a regular and continuous way? So far as we can understand there can be no reason; and, if it should, we have a new species, not springing from a seed, or one individual plant—constituting one geographical centre of creation from which all subsequent descendants emigrated and spread themselves—but a whole brood of new individuals already widely distributed over the earth's surface, and entirely freed from the "struggle for existence" which the developement of a species from a solitary individual pre-supposes.

Aside from the great value of this illustration of how the whole character of a species might be modified simultaneously over a wide extent of country, it afforded a lesson in environment. External circumstances may influence modification, but only in a line already prepared for modification. This must necessarily be so, or change would be but blind accident, whereas palæontology teaches

1 See Proc. Amer. Assoc. Ad. Science, volume xxiii, p. B. 9.

us that change has always been in regular lines, and in co-ordinate directions which no accident has been able to permanently turn aside. Just as in the birth of animals, we find, that however powerful may be some external law of nutrition, which, acting on the primary cell of the individual decides the sex, yet we see that no accident has been able to disturb the proportion of the sexes born, which has always been, so far as we know, nearly equal. So in the birth of species, making all allowances for the operation of environment, the primary plan has been in no serious way disturbed; we have to grant something to environment in the production of new forms, but only as it may aid in innate power of change, ready to expend itself on action as soon as the circumstances favor such development—circumstances which after all have very little ability to determine what direction such change shall take.

We know that distinct forms do spring through single individuals from seed, and that after battling successfully with all the vicissitudes of its surroundings, a new form may succeed in spreading, through the lapse of years or ages, over a considerable district of country. But the idea that always and in all cases species have originated in this manner, presents, occasionally, difficulties which seem insurmountable. In the case of the similarity between the flora of Japan and that of the eastern portion of the United States, we have to assume the existence of a much closer connection between the land over what is now the Pacific Ocean, in comparatively modern times, in order to get a satisfactory idea of the departure of the species from one central spot; and to demand a great number of years for some plants to travel from one central birthplace before the land subsided, carrying back species in geological time further, perhaps, than mere geological facts would be willing to allow. But if we can see our way to a belief that plants may change in a wide district of country simultaneously in one direction, and that these changes once introduced, be able to perpetuate themselves till a new birth-time should arrive, we have great advancement towards simplifying things.—*Proceedings of Philadelphia Academy of Science.*

ASTRONOMY.

SUN AND PLANETS FOR JANUARY, 1885.

W. DAWSON, SPICELAND, IND.

About an hour before New Year's the Sun is in Perigee, its nearest point to the Earth, when its R. A. is 18h. 48m.; and declination 22° 00′ S. Thus it has started northward and the days are growing longer. Spots on the Sun have broken out considerably since their disappearance November 8th. On the 14th of November there were five groups and fifty spots. December 2d four

groups and sixty-six spots. On the the 8th I counted only fourteen spots. The weather has been unfavorable since then—now the 18th.

New Moon occurs January 16th, about 3:00 A. M., and Full Moon on the 30th at 11:00 A. M. The Moon passes over and hides for nearly an hour, the star Theta Libræ, in the morning of January 10th, about 3:00 to 4:00 o'clock. Another phenomenon of considerable interest will occur near 7:00 P. M., January 28th, viz.: the passage of the Moon very near a star (Lambda in Gemini) so that the star will appear to pass very near the south edge of the Moon, and may be actually hid for a few moments. In such a case it may be possible, with a good telescope, to see the star disappear and re-appear alternately among the high mountains on that part of the Moon. Such an observation would, at least, be quite interesting.

Mercury comes to inferior conjunction with the Sun January 3d; and greatest elongation on the 26th, when it will be nearly 25° W. of the Sun, and may be observed as a moving star. Venus is still a Morning Star in the southeast. Mercury will be 1° north of it in the morning of the 24th. Mars is too near the Sun to be visible. Jupiter rises some north of east about 9:00 o'clock January 1st; and at 7:00 o'clock on the 31st. So it will be in good position for observation toward the last of the month. Its four moons may be seen with a spy-glass. Saturn is as well situated for evening observation as it can be. It is considerably below and north of Pleiades, forming a triangle with them and Capella. It is three hours high at 6:00 o'clock January 1st. Its ring and one moon (Titan) can be seen with a good-sized spy-glass. Uranus is nearly between the stars Eta and Gamma of Virgo, just visible to the naked eye when the sky is clear and Moon absent. Neptune is in a starless region of Taurus, about 8° southwest of Pleiades. It is quite invisible to the naked eye, and can only be found by the aid of an equatorial telescope.

NATURAL HISTORY.

ODDITIES OF ANIMAL CHARACTER.

Mr. J. S. Mill, in his essay on "Liberty," long ago warned us against the stupefying influence of custom upon human beings, and held that we ought to encourage eccentricities in each other, and to guard jealously the right to be eccentric, instead of insisting on reducing every one by the hard-and-fast Procrustean standard to a single dead level of mediocrity. But, whatever our sins may be in this respect toward human beings, surely they are greater still toward the domestic animals. We reduce our horses, so far as possible, to the mechanical condition of locomotive engines—indeed, eccentric horses might involve very serious dangers to life and limb—our dogs to sentinels, which we drill to a social

decorum as rigid as our own; while we regard the eccentricities of a cat with undisguised horror, as the mere prelude to dangerous insanity. No one who watches can fail to see how bigoted we are against anything like a "new departure" among our poor relations. If a man begins to save up against his old age, we call it thrift, and praise him as a small capitalist who is giving hostages to fortune; but if a dog accumulates a store of bones or food, we look upon him as indulging in dangerous caprices, which may end in the necessity of putting a bullet through his head. There may be exceptions here and there. Sometimes you will find an old lady who will protect eccentricity in a parrot, a magpie, or a jackdaw, as a bird that has a right to a certain freedom of movements in return for its entertaining attempts at conversation.

But, on the whole, there is no sterner standard of conventionality than that which we enforce on our domestic animals. Pet dogs become perfect bigots in favor of the usual, and persecute any attempt to deviate from it on the part even of a more powerful and less favored colleague, as the Inquisition persecuted heresy, or as the court of Russia persecutes Nihilism. There is nothing equal to the indignation of an in-doors dog at any invasion of the privacy of the drawing-room by an out doors dog, and nothing more melancholy than the servile apologies which the big dog will make to the little one, for even proposing to break through the animal etiquette of the house. The horror of the queen's chamberlain, when once an officer presented himself at the *levee* in the proper court suit diversified by slippers, which he had forgotten to exchange for the regulation boots, was not so great as the horror of the terrier and the Pomeranian when a collie or a setter presents himself on the threshhold of their mistress' sitting-room. We smother the genius of our dogs with our conventionalisms, and stifle the originality of our cats with luxurious bribes. We did, indeed, meet the other day, within the precincts of a great cathedral, with a young cat who was spoken of as "epoch-making"—as likely even to originate a new hegira by the fervor of his genius. But even of his great promise we could gather no articulate account. He was still in the period of early youth, and perhaps was brooding over the designs by which he hoped to transform, in some future day, the world of the cathedral close. But, as a rule, it is certain that we teach our domestic animals as the Cingalese teach their tame elephants, to discourage steadily and effectually everything like eccentricities, whether deliberate or capricious, or assertions of liberty, on the part of their wilder colleagues, and so drill them into our dead level of habit.

What important variations of character, however, might we not promote if we took more pains to foster what a writer of thirty years used to call "the individuality of the individual" among our friends of the lower races! Sir John Lubbock thinks that he has partially taught a poodle to read, but, as a correspondent of ours once suggested, that may be a step in the wrong direction—not a development of the true genius of the dog, but an attempt to merge the genius of the dog in the habits peculiar to man, and likely rather to result in ingrafting an imitative humanity on a totally different kind of capacity. On the other hand,

in his experiments on ants, Sir John Lubbock has gone on the sounder principle of setting the ants problems to solve for themselves—a principle which has resulted in showing that different races of ants have very different resources and that different individuals, even in the same race, show a very different amount of resource in dealing with the same difficulty. This is confirmed by what we know of our more intimate friends among the domestic animals; and surely we should do more to develop their capacity by stimulating them to meet difficulties by their own resources than we can effect by taking their training so completely under our own care. Is it not possible that, as things go, the companionship of man is rather an incubus on the natural genius of the inferior animals than a a help to its development? It is clear that the ants, at least, are more sagacious in proportion as they live more apart from man, and are thrown upon their own resources. The harvesting-ants of Texas and the leaf-cutting and military ants of Nicaragua are far higher in civilization than the ants of the more densely peopled countries of Europe. In proportion as they have a freer scope for their efforts, their social communities appear to be founded on a more advanced intelligence and organization. Is it not possible that we stunt the intelligence of our humbler fellow-creatures by doing so much for them, and permitting them to do so little for themselves?

Certainly there is far too little disposition to allow of eccentricity in the lower animals and for what comes of eccentricity. Half-domesticated birds, however, will occasionally show very remarkable eccentricities, and even appear to be making experiments—though experiments which we should, of course, regard as of a very unscientific kind—in the modification of their own instincts. The present writer knows a pigeon of exceedingly eccentric disposition, not unlike "the single gentleman" in Dickens' "Curiosity Shop" in his habits. He keeps seven pigeon boxes all to himself, and persecutes relentlessly any pigeons which propose to share their dwellings with him. He is as averse to the society even of the gentler sex as was St. Anthony himself in Egyptian deserts. Not a pigeon will he admit within the circle of his sway. And yet, in spite of this resolute and inveterate bachelorhood, this eccentric pigeon is always endeavoring to build nests, and looking out for objects of an egg-like form, which he thinks it possible to hatch. He will accumulate twigs and straws now here, now there, at very great pains and labor. He will coo sometimes to inanimate objects, sometimes to captive birds of another breed, sometimes to a kitten or a dog, or even a flower-pot, with the quaintest and politest antics. He will sit patiently on China-saucers on the mantel-piece of one room, while he accumulates the materials for a nest on the top of a closet in another room. He does not even drive away the possible mother of a family with more zeal than he shows in seeking to be a good father to some imaginary chick which he seems to expect to elicit from a ring-stand or a letter-weight. So for as the writer can judge, he is a pigeon of strong Malthusian views, who hopes to inaugurate a new *regime* which may have the same relation to the ordinary habits of pigeons which the Positivist worship bears to

the other religions of the world. He hopes to foster and cultivate the family and parental idea without any corresponding reality, without any aid from outside, indeed, except an apparatus of external ceremony, which feigns the exististence of a purely ideal mate, and affects to indulge in the expectation of impossible offspring. Doubtless he thinks that there is nothing so good as the courtly attitude of a pigeon toward his mate, especially if there be no mate to justify it; nothing more touching than the patient preparation for offspring and the education of the young, especially if there be no young to complicate the problem of tenderness and foresight, by requiring a real supply of food and attention.

This eccentric pigeon seems to be a solitary thinker of the Comtist kind, who hopes to solve the problem of preserving to the full all the higher instincts of bird-life, without the difficulties involved in supplying those instinct with real objects. If a human thinker can empty religion of its meaning, and yet justify all its forms and sentiments and external rites, and if he is to receive nothing but praise for his achievement, why may we not regard with interest and admiration the effort of an eccentric bird to retain all the ceremonial forms of chivalrous observance and elaborate parental care and patience, without, in fact, complicating the situation by admitting the neighborhood of either wife or child? To our mind, the idiosyncrasies of such a creature as this deserve the most attentive study. Who knows whether we might not find in the world of eccentric instinct all sorts of anticipations of eccentric intellect? Who knows whether we might not find genius and originality in other races of animals which would throw as much light upon the genius and originality of man as the eccentricities of this pigeon seem to throw on the eccentricities of a most active and confident school of modern thought? If John Stuart Mill were right in thinking it a sacred duty not to discourage the milder lunacies of human beings, might we not with equal advantage extend his exhortation, and make it include the duty of protecting the independent development of the idiosyncrasies of bird and beast, in the hope of finding in them some clew to the various oddities and harmless insanities of human thought and action?—*American Field.*

BOOK NOTICES.

SECOND ANNUAL REPORT OF THE BUREAU OF ETHNOLOGY, 1880–81: By J. W. Powell, Director. 8vo., pp. 477. Illustrated. Government Printing Office, 1883.

The first part of this handsome volume consists of an account of the operations of the Bureau for the fiscal year by Major Powell himself, the remainder is devoted to special papers by his assistants, illustrating the methods and researches prosecuted under the direction of the Bureau.

Among these papers are an account by Frank H. Cushing, of the Smithson-

ian Institution, of some peculiar rites studied by him while living with the Zuni Indians of New Mexico, entitled "Zuni Fetiches;" one by Mrs. Erminnie A. Smith, entitled "Myths of the Iroquois;" a third by H. W. Henshaw upon "Animal Carvings from Mounds of the Mississippi River;" "Navajo Silversmiths," by Washington Matthews; "Art in Shell of the Ancient Americans," by Wm. H. Holmes; "Illustrated Catalogue of the Collections obtained from the Indians of New Mexico and Arizona in 1879 and 1880," by James Stevenson.

All of these articles are written by persons who have given careful and critical study to their respective subjects and most of them are very copiously illustrated in the handsomest manner.

The investigations of the Bureau have been conducted systematically and the object has been the definite and logical study of arts, institutions, languages, and opinions, each depending upon, and to some extent inseparable from, the other. As Major Powell well puts it, "The study of the arts is but the collection of curiosities unless the relations between arts, institutions, language and opinions are discovered. The study of institutions leads but to the discovery of curious habits and customs unless the deeper meaning thereof is discovered from arts, languages and opinions. In like manner the study of words unless philologic research is based upon a knowledge of arts, institutions and opinions. So also the study of opinions is but the collection of mythic stories if their true meaning is not ascertained in the history of arts, institutions and languages."

With this view of the subject properly understood, the student of ethnology will not long be regarded by the average person as a mere collector of old pottery, arrow-heads and musty bones, but will soon come to occupy his proper place among scientists.

TRAVELS ON FAITH FROM TRADITION TO REASON: By Robt. C. Adams. 12mo., pp. 238. G. P. Putnam's Sons, New York, 1884. For sale by M. H. Dickinson.

This handsomely printed volume is devoted to an account of the writer's experiences in passing from a supposed religious state, through all the phases of doubt and unsettlement, to that of rank infidelity. He is the son of a Presbyterian minister and was brought up by a Christian mother, being taught, as all New England children were in those days, the stern theology of the "shorter catechism" and other Calvinistic doctrines. With such a foundation it is surprising how soon he began to doubt, and more surpsising upon what meagre quibbles his doubts depended. He became a sea captain and having much leisure time on his hands, devoted it to studying the Bible and theological books. He attended church when on land, and apparently earnestly sought to be a Christian and lead a Christian life. Nevertheless his hold upon religion was too slight to bind him and he drifted farther and farther from the teachings of his youth until he actually became a "pagan" of the Bob Ingersoll type, satisfied with being

able to ridicule the Bible and religion by selecting passages separated from context and general plan and holding them up as expository of God's purposes and disposition.

This conception of religion, despite all his teachings and studies, is inconceivably narrow and shallow, never rising to the comprehensiveness necessary to take in anything more than details which are mistaken for principles and failing to grasp the full range and scope of the Bible or to obtain a full grasp of the principles involved. He is almost equally deficient in his understanding of the theories of evolution, which he says gave him "a reasonable conception of the universe and seemed to put solid ground" under his feet. The whole work is a marked instance of what misguided study and misdirected energy, together with restless and unsatisfied nervous temperament, will lead one to in any branch of study.

It is a book which would do serious harm in a school library if read by the children, but which may be perused with impunity by any mature person of well balanced mind.

PRIMARY HISTORY OF THE UNITED STATES: By Edward S. Ellis. 12mo., pp. 224. Van Antwerp, Bragg & Co., Cincinnati, 1884. For sale by M. H. Dickinson.

This little work belongs to the eclectic educational series published by the above named firm, and is a credit to them in point of paper, printing and illustrations. Nothing is more noticeable even to middle-aged persons than the great improvement made within their memories, in school books, both in matter and appearance.

The author has of course attempted to do no more than to chronicle in simple language only the most important events, explain the causes of national movements, and point out the wonderful progress of the United States in everything that makes up a nation. The review questions appended to each chapter are valuable aids to the pupil in indicating memorable points and fixing them in his mind. Such school books deserve a place in all good schools.

REPORT OF AN ARCHÆOLOGICAL TOUR IN MEXICO IN 1881: By A. F. Bandelier. 8vo., pp. 326. Illustrated. Cupples, Upham & Co., Boston, 1884.

This is the second volume of archæological papers published by the Archæological Institute of America, whose president is Charles Eliot Norton and whose secretary is E. H. Greenleaf. The author calls his work an archæological reconnoisance into Mexico, and divides it into four chapters, viz: From Tampico to the City of Mexico; Notes about the City of Mexico; Studies about Cholula and its vicinity; An Excursion to Mitla.

There are twenty-six plates, most of them heliotypes, with hundreds of figures

and illustrations in the text. Many of these are from drawings by the author and the remainder from photographs.

Mr. Bandelier has been employed for several years past by the Institute, first in New Mexico where he studied the Pueblos, and afterwards in Old Mexico where he has devoted himself to the interesting ruins of that country. He is a graceful and interesting writer and an explorer who knows what to look for and how to investigate it, which is more than can be said of all explorers. The subject, though old, is ever attractive, and though Humboldt and LePlongeon, Bancroft and Charnay, besides numerous Spanish, French and Italian explorers, have described these wonderful ruins over and over for several centuries past, this new story of their mystery and grandeur will be read with renewed and undiminished interest.

The Institute has put it forth in handsome style, through its publishers, and can supply any demand upon application to Mr. Greenleaf.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, MAY TO OCTOBER, 1884. Edited by Edward J. Nolan, M. D. 8vo., pp. 144. 1884.

The promptness with which this volume has been produced, so unusual with scientific bureaus and societies, is worthy of all commendation. Its contents are, as heretofore, highly attractive from their originality and the nature of most of the subjects discussed. We find among the contributors the names of Professors Leidy, Meehan, Gill, Lewis, Doctors Foote and Brinton, Rev. H. C. McCook and several others less well known in the West. Among the, to us, more interesting papers we note that upon Rapid Changes in the History of Species, by Prof. Thomas Meehan; Rev. Mr. McCook's articles upon the Habits of Spiders, and that of Dr. D. G. Brinton upon "The so-called Bird-Track Rock Sculptures of Ohio." Other papers will commend themselves to other readers who are interested in biology, botany, geology, physiology, etc.

No society of the kind in this country does more original or better work than this.

OTHER PUBLICATIONS RECEIVED.

Signal Service Notes, No. XVI: The Effect of Wind Currents on Rainfall, by G. E. Curtis, U. S. Government Printing Office. Humboldt Library, Double Number, 30cts., No. 62—The Religions of the Ancient World, including Egypt, Assyria, Babylonia, etc., by Rawlinson, M. A., published by J. Fitzgerald, N. Y. A Manual of Geology, with classification tables, by Prof. S. H. Trowbridge; published by National School Furnishing Co., Chicago Ill. Oxygen and Ozone: Their Applications, by Prof. Anton Stamm; published at Leadville, Colo. A Spectro-Photometric Study of Pigments, by Edward L. Nichols, Ph. D. Bul-

letin of U. S. Geological Survey No. 9, Government Printing office. Economic Tracts No. 14: The Competitive Test, by Edward Shepherd; published by Society for Political Education, New York. Humboldt Library No. 60—The Childhood of the World: An Account of Man in Early Times, by Edward Clodd, F. R. A. S., price 15cts; Fitzgerald, publisher, New York. Questions of the Day, No. 13: Public Relief and Private Charity, by Josephine Shaw Lowell, price 40cts; G. P. Putman's Sons, New York. Humboldt Library, No. 61, price 15cts: Miscellaneous Essays, by Richard A. Proctor; Fitzgerald, publisher, New York. Annals of Mathematics, by Ulmund Stone and M. Thornton, Vol. 1, No. 3, Charlottesville, Va. The Song Friend, Vol. 5, No. 12; published by W. S. Staub, Chicago, $1.00 a year. Professional Papers of Signal Service, No. 14: Charts of Relative Storm Frequency for a portion of the Northern Hemisphere, by John P. Finley, Government Printing Office. Economic Tracts, No. 15, The Standard Dollar, by H. W. Richardson, N. Y. U. S. Consular Reports: Reports of Consuls of U. S. on Commerce, Manufacture, etc., of their Consular Districts, No. 45, Government Printing Office.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

COMBINED CUFF-HOLDER AND SLEEVE-SUPPORT.—This invention relates to that class of devices in which the cuff is supported by spring clamping-jaws, and it consists of an S-shaped strip of metal that is so combined with a suitable pin as to be adapted for fixture within a coat-sleeve, where, by reason of its spring-jaws it will hold the cuff securely in place.

By dispensing with the pin, however, the strip of metal becomes simply a support for the wristlet of the sleeve, and it is applied by placing it upon the edge of the cuff, in which position it is held by reason of its inherent spring power. Now upon the entrance of the descending wristlet within the cuff, it comes in contact with the inwardly-projecting arm of the instrument and is thereby prevented from falling so low as to be exhibited upon the wrist.

In construction, a suitable piece of metal being provided, it is bent at one-third its length or doubled toward its main position to form the two clamping-arms and in an opposite direction to form the supporting-arm. The pin may then be, or may not be, attached as desired.

ELECTRICAL GAME-INDICATOR FOR POOL TABLES.—This improvement provides an efficient indicator whereby the person in charge of a number of tables is

instantly made aware of the beginning of a game and of the particular table upon which it is in progress.

The apparatus consists mainly in constructing both the spot and the triangle of metal, and of placing them in electrical communication with a suitable indicating dial.

The improved metal spot is preferably constructed with a shoulder near its upper end for forming a bearing when it is let down level with the upper surface of the table. A pin or dowel is provided upon its lower extremity in the form of a binding screw to which the circuit-wire is attached. The spot is perfectly insulated in its position upon the table.

In operation, a battery and an indicating dial are located at such a point in the room as will be convenient for inspection, the spot and the tri-angle are connected by suitable wires to the battery and to the dial. Whenever the table is idle the tri-angle is of course removed from the spot, but, when a game is commenced, the tri-angle is placed in position upon the table in contact with the metal spot, the circuit is thus closed and the fact is indicated by the dial.

THOUGHTS ON SCIENCE TEACHING.

ALEXANDER WINCHELL.

The so-called "inductive sciences" are by no means exclusively inductive. Nor can all science-teaching be conducted exclusively by observational methods. On these two points much erroneous doctrine has been inculcated. Aside from certain rational principles which regulate all intellectual processes, it may be said that the so-called inductive sciences begin by induction, and are founded on facts of observation. The knowledge of the facts is the condition of the existence of the science. The facts, while not constitutive of science, are the data of science; and in a process of education they must be acquired. A real portion of the science consists of the body of generalizations based on the facts. Any real knowledge of the science must grasp these principles. But the body of propositions generalized from the data of science may next be employed as grounds of deductive inference. Only thus does science attain to a knowledge of facts inaccessible to observation. Thus science becomes a seer, and her vision penetrates beyond the limited range which bounds the ken of the human race. It is only by deduction from generalized principles that geology, for instance, can venture any affirmation concerning the history of the world in the ages before human observation, or can predict vicissitudes impending in the remote future. Those portions of a science reasoned out from general principles often constitute its most important domain. They generally afford the most entertaining and inspiring themes for contemplation, and this is evidently because the method carries us through time and space and causation to distances most remote from the little circle which limits the sphere of facts merely observed.

We are thus reminded that the subject matter of science, aside from the transcendental concepts and cognitions which are always implied, consists of: 1. Facts of observation. 2. Principles generalized from the facts. 3. Other facts deduced from those principles.

Here are three different kinds of knowable materials to be dealt with by the teacher of science. As to the facts, it scarcely needs to be said that the most effective method of imparting a knowledge of them to others is the *observational.* If the facts of science are to be learned, the best way is to bring the facts and the learner together. The method of the Kindergarten, the laboratory and the field is truly the most efficient and the most agreeable. Too much can not be said of the importance of giving full exercise to the percipient faculties, within all the range where their activity is possible. But next, if direct observation is impossible, the *pictorial* method is the best substitute, provided the pictures are intelligible and correct. Poor pictures are misleading and a weariness. But if these are not available in imparting a cognition of the facts, we must employ the *descriptive* method. Here everything depends on the clearness of the describer's conception of the thing, and the power of the learner to picture mentally the thing described. These are powers of the imagination. Their exercise by the teacher gives vividness, reality and clearness to the fact set forth. Their exercise by the learner gives vividness of conception which is the next thing to visual perception. In the description of objects of natural history, some describers, with the object before them, can not phrase a description out of which a picture could be formed. Some who read the most accurate and vivid descriptions have no power to render them in a clear mental picture. Hence the descriptive method as a dernier resort, is neither to be employed undiscriminatingly, nor condemned unconditionally.

Next, as to the generalizations, the *ratiocinative* process of acquisition should be promoted in all cases; but where the powers of the learner are incapable of seizing the generalization, it must be enunciated *dogmatically.* The generalization is the first attainable constituent of the science. It is of pre-eminent importance, and is imagined by some to be the only genuine scientific material. It is well if the pupil can view the facts under such a presentation as to draw the inference for himself. But the inference must come into his possession, if only received on the authority of the teacher.

As to the deductive materials of science, they presume the existence of generalized principles, and their acquisition by one of the two methods just indicated. The deductive inferences from them should be drawn by the unaided action of the learner's intelligence, where the process is not too recondite. More frepuently, however, the learner can do no better than to listen to the detail of inferences drawn by a teacher of adequate knowledge, reflection, and power of statement. The teaching is either *ratiocinative* or *dogmatic.*

The data and principles of science and of teaching, thus recalled to mind, reveal, manifestly, a certain range of scientific knowledge which may be approached by the observational method, and should be so approached. The acquisition of all which remains must be left to the action of the learner's ratiocin-

ative powers, or, more frequently, to the dogmatic enunciations of the teacher. This discrimination cannot possibly be ignored. To insist that all scientific acquisition shall be by the observational method, is to betray ignorance of the material of science. The most important, the most real and the only fundamental part of science is accessible only to rational perception, not to sensible perception. To denounce the didactic or descriptive presentation of facts is to assume that all facts can be brought before the sense of the learner, and this is a baseless assumption. To denounce all dogmatic statement of general principles, is to assume that the tottering intellect of the young learner is capable of drawing the same generalizations as have been framed by the sturdiest efforts of experts, and this is a baseless assumption. To denounce all dogmatic statement of deductive inferences is to confess inability to perceive the cogency of *a priori* evidence, and thus abdicate the privilege of passing judgment on it; or, if the validity of deductive science is admitted, it is to assume that the learner is already capable of taking, unsupported, the loftiest flights of scientific speculation—a consequence, the very mention of which annihilates the assumption. There must be sometimes a descriptive statement of facts. There must be a dogmatic delivery of inductive doctrines. There must be, unless we would have our teaching grossly defective, a frequent dogmatic exposition of the necessary consequences of established principles.

Finally, as to the times and circumstances under which these various methods of teaching may be employed, we have a few words to offer. Let us first consider the learner of tender years. It requires no argument to make it appear that the generalized and deductive principles of science are not appropriate, or, in any event, are less appropriate, than the facts, to the active percipient powers and the late awakened reflective powers of the young. It seems, however, to require argument to establish the belief in the minds of educators, that the learning of the facts of science is positively suitable to the faculties and aptitudes of the young. If the proposition were accepted, we should not see children and youths shut up for years to the abstractions of arithmetic and grammar, the sporofic and comparatively unproductive details of historical names and dates, or the meaningless and profitless lists of capes and headlands along some remote barbaric shore. We are not denying the usefulness of these things, nor even their comparative usefulness. We strongly feel, however, that during the stage of childish perceptivity, there is greater appropriateness and productiveness in the exercise of the faculties upon facts of present interest, and which actually enter into the organization of sciences of transcendent influence and importance. But, whatever finally may be agreed as to the propriety of introducing the natural sciences to the attention of the child, it can hardly be denied that the most rational method of doing this is to bring the child into contact with the facts, and leave his own mind, as far as it is able, to draw the general inferences to which the facts point. It follows that books and teachers which aim at a systematic, synthetic presentation of one of the natural sciences, forget the order of development of mental faculties, and prepare to leave a sense of weariness and disgust where there

might be a feeling of interest and delight. The only rational procedure with the child, in the study of rudimentary geology, for instance, is, therefore, to take him into the field and permit his faculties of observation and thought to lead him, by the natural processes of investigation and discovery, to the apprehension of those principles which constitute the inductive department of the science. His own faculties then are active, and to some extent, in all cases, the principles reached are principles discovered; the child feels a consciousness of success—a pride in it, an exhilaration over it, and the whole exercise is a delight.

If the case be that of a person entering on a thorough course of scientific study, then equally, an examination of the facts which constitute the data of the science is the first thing in natural order. This is the nature of the study in an elementary course, whether the pupil be a child in the grammar school or a senior in college. But the style of the presentation will vary with the maturity of the learner, and so will the prompting needed in drawing the appropriate lessons from the facts. It is a needlessly prosaic, heavy and deadening process to start a course in science with the conning and memorizing of abstract general statements which rest on no evidence visible to the learner, and sustain no recognized relation to any body of knowledge which interests and inspires, and lifts up the mind. With all the inspiration which belongs to science, it is easy to give it a cold and soporific presentation to the beginner. The order of ideas in the historic development of a science is nature's order in the development of the same ideas in the individual mind. What is most natural is most pleasant and most profitable.

As the study of the science proceeds, the student's mind is prepared for the reception of the higher generalizations, and the far-reaching results of deductive reasoning. The skillful teacher will cause the data to pass before the learner's mind in such order as to prompt the mind, through its own energy, to reach these inferences as original discoveries. That is the best teaching, and those are the best text-books, which secure the most of this productive spontaneity. But, as before stated, much must always be enunciated by authority. Especially, while the person continues in the relation of pupil rather than independent investigator, will it remain appropriate and best for the teacher in his own language and way, to enlarge upon the far-reaching consequences of those modes of being and action which are expressed in the higher generalizations of science. To trace those consequences leads the learner's thoughts and imagination into realms so remote from present experience that novelty and wonder lend new incentives to attention and add exalted interest to the conceptions of the science. These higher generalizations and loftier deductions are a grand sequel to the earlier details of facts and the later formulation of doctrines, and they may advantageously be reserved for formal lecture presentation.

There are still other circumstances in which every teacher of science is liable to find himself sometimes placed. Multitudes of persons who cannot or will not pursue any thorough course of scientific study, still desire a knowledge of the grand results of science. This, indeed, is all which the world at large cares for.

It is in truth all which enters into the cultural influence which science exerts upon the intelligence of the masses. Now, as has been shown, this class of scientific knowledge, to those who have not reasoned up to it from the facts, must necessarily be imparted by means of dogmatic statements, and the learner must rest content with the results, ignorant, largely, of the data from which they have been reached. This may be half-knowledge, but beyond question, it may be very interesting and very valuable knowledge. This is the department of scientific knowledge best suited for impartation through popular lectures. It is the aspect of science to which the popular intelligence always turns with eagerness. Still, it is not to be supposed that the highest appreciation requires the exclusion of all statements of fact. The mind—even the popular mind—takes delight in its own activity. It likes to trace the relations of causality by means inductive and deductive. The lecturer, for instance, may direct the attention of his hearers to the familiar phenomena of erosion, occurring within the narrow sphere of his own observation. The hearer will easily follow the generalization of this action into a universal phenomenon; and then, by a mental process equally agreeable, he will accompany the lecturer in a delineation of the ulterior consequences of such geological action. The experimental sciences afford superior opportunities for conducting the hearer over the steps of fact, generalization and deduction. But to assume that no popular instruction in science is legitimate which does not accompany every conclusion by its appropriate proof, is the affectation of a mind which has been running in a rut. To summarize results, we may say that instruction in natural science intended for youthful learners, should deal chiefly with the concrete data, giving occasional glimpses of the ratiocinative procedures to be based on them. Definitions and general enunciations should come at the end instead of the beginning. This work compasses the rudiments of the science. For all persons entering on a thorough course, a similar method should be pursued, extending the range of logical inferences as knowledge accumulates, or the maturity of the learner is more advanced. The inductive method may well be supplemented by formal, descriptive, didactic and dogmatic presentations.

This instruction may cover the fundamental facts and doctrines, and the prominent theories in the science. It embraces the elements of the subject, and ought always to be acquired during the preparation for college. The third phase of scientific teaching, which may be noted as collegiate, should combine the same method with a larger supplement of lectures designed to gather into a unity, with a clearer co-ordination of parts, the somewhat disjointed results of observational and inductive study, and to lead the learners mind over the lofty ranges of remoter generalization, and ulterior results of the causes in action. A fourth form of presentation is the popular, in which the interest and profit of the learner require a minimum of facts and a maximum of general conceptions. Thus the method of instruction in natural science is not one and uniform. It must vary with the subject matter and with the age and aims of the learner. It may be rudimentary, preparatory, collegiate or popular, and in each case a different pro-

portion of the concrete and reflective constituents of science must be presented to the mind.—*Fortnightly Index.*

THE NATIONAL EXHIBIT AT THE NEW ORLEANS EXPOSITION.

In addition to the grant of $1,000,000 made by Congress as a loan to further the project of a World's Fair, and Cotton Centennial in New Orleans, an appropriation of $300,000 was made to enable the various departments of the national Government that are depositories of the nation's historic and industrial annals to make a fitting display. The most imposing and valuable exhibits will be made by the various bureaus comprised in the interior department, represented by Hon. Benjamin Butterworth, commissioner of patents. The manner with which the preparation and arrangement of the vast exhibits of the various bureaus have progressed insures a display that will appropriately and fully place the industrial life and immense mineral wealth of the country before the world.

The bureaus under the department of the interior which will contribute to the exhibit opened on December 16, 1884, are the Patent Office, General Land Office, Bureau of Education, Census Office, United Sttates Geological Survey (which includes the Bureau of Ethnology), and the Office of the Commissioner of Railroads. These exhibits will be ready for shipment to New Orleans in a few days. They will illustrate in a comprehensive manner all the important industries and interests in the United States.

The Bureau of Education will present in school architecture, models and drawings of schoolhouse structures, from the most primitive times up to the most improved building of the present day. Photographs and photo-lithographs will supplement the models and form a considerable part of the exhibit. The fixtures of the school-room, such as are used for heating, ventilation, and the modification of heat and light will be presented. The kindergarten will be shown with all the material which is used in that kind of a school, and a considerable amount of children's work. It is intended that this section shall be under the immediate supervision of an experienced teacher of kindergarten, and that much pains will be taken, not only with the kindergarten itself, but with the material for the instruction of young children.

Primary, grammar, and high school rooms will be fitted up with desks, apparatus, charts, maps, specimens of scholars' work, text-books, and any other material that may fairly represent the appliances found in our best schools. The college rooms will be similarly fitted up, and will be made to display, so far as possible, the contributions of colleges to the bureau for use in this connection.

Professional education, especially the teaching of medicine and dentistry, will be amply illustrated by charts, photographs, and plans of medical buildings; by the instruments used in the profession, and in such other ways as the ingenuity of the medical profession may suggest. The schools of science and technology are expected to contribute largely of their products to the section especi-

ally devoted to institutions of this character. Plans of bridges, buildings, and machines, and constructions of various kinds will form a part of the display of the schools of technology. The schools for the education of the deaf mutes and the blind and reform schools are to be especially represented by their products, coming not only from their school-room, but also from the shops which are frequently a part of these schools. A library room has been planned in which there will be found current numbers of the educational periodicals of the country; the most useful books for teachers; the various city, State, and national reports on education; specimens of foreign reports and periodicals, and other material of a similar nature.

The representation of statistics by charts will be largely shown in this room; the statistics of illiteracy will be presented by colored maps, showing the localities in which education has been most neglected. Physical and chemical laboratories have been planned by professors of these subjects, and will be so arranged as not only to display the apparatus illustrating the different departments of these sciences, but to show visitors some of the more common and useful experiments which are performed before classes in physics and chemistry. The manual training schools which have sprung up in the country since the centennial will be represented by the tools and machines which are used in these schools, and it is believed that under the management of a skillful superintendent the actual operation of these schools in teaching carpentering, forging, machine work, and the like, will be handsomely displayed. The schools of art of the country will be represented by their product, which will form a most interesting part of this display. It is believed that this bureau will make a most interesting and instructive exhibit to all who feel an interest in a more advanced stage of education.

The Census Office will illustrate by a series of illuminated charts and diagrams, together with some geometrical figures, the present stature of this country, and its growth by decades, as far as may be possible, in population, agriculture, manufactures, mining, forestry, fisheries, and other material interests. The present standing of the United States, as compared with foreign countries, will be indicated by a combination of figures and illustrations showing our relative population, industrial employments, and value of products, acreage and agricultural products, wealth, taxation, and indebtedness, with interesting comparative data relating to the defective and dependent classes of the people to their social progress, occupations, etc.

The Geological Survey comprises also the bureau of ethnology. During the last five years this bureau has made large collections of the products of aboriginal art, both ancient and modern, such as textile fabrics, pottery, implements of war and of the chase, with other curious objects, many of which were used in their periodical ceremonies and dances; these latter will be arranged by Mr. Frank Cushing, who is familiar with the mystic rites of these people, and will make an interesting exhibit. Col. James Stevenson has been in the far west during the past two or three months collecting important additions to these ex-

hibits, all of which will be displayed in the National Museum after the close of the exposition.

Among other objects of interest and wonder will be the series of models of the towns of the existing Pueblo tribes, and of the ruins, cliff-dwellings, and towns of the pre-historic peoples. An entirely new series of these has been made on a scale of one-sixtieth—large enough to show much of the interesting details of their architecture and habits of life. The model of the Pueblo of Zuni, the largest, is upward of twenty feet long. Appended to this display will be a number of models of the mounds, earthworks, etc., of the mound-builders. A series of the relics of stone, clay, metal, various tools and implements, and a representation of the skeletons obtained from the mounds. This branch of the work is under the special supervision of Prof. Cyrus Thomas, who has been engaged during the past four or five years investigating the origin and possible history of these unknown people.

The Geological Survey will furnish a number of models of the more important geologic and typographic features of the far west,—the Grand Cañon of the Colorado, the Yellowstone Park, the Yosemite Valley, and the grand district of the Rocky Mountains. There will also be a number of models of the great mines of Colorado, Nevada, and California.

A fine collection of the largest and most elegant photographs ever made will be shown by the transparencies, and will be an exceedingly attractive feature of the exposition. There will be 150 of these pictures which will illustrate chiefly the people and scenery of the far west. They will be returned to the National Museum after the close of the exposition.

There will also be sent from the United States Geological Survey specimens representing the ancient life of the globe, the fishes and reptiles of strange form, some of them of immense size, the multitude of remarkable quadrupeds which have become extinct, the infinitely varied forms of shell fish which have inhabited the seas of former geological periods, and remains of the mighty forest trees that once covered a large portion of the earth's surface, and which have been succeeded by those which now decorate the earth. This exhibit will include minerals of nearly every kind known to science, from the beautiful and costly gem to the common clay of the potter; ores of every metal known to human industry, representations of the mines whose wealth is fabulous, maps and charts showing the location of all this natural wealth, the extent and methods of its development, and giving plain indications of their future productiveness.

The space required for the exhibits of the interior department is as follows: For the Patent Office, 15,650 square feet floor and 1,800 feet wall space. Geological Survey, 10,000 square feet floor and about 1,500 wall space. Pension Office, 600 feet floor and seventy-five feet wall. General Land Office, 300 feet floor and 1,400 feet wall. Commissioner of Railroads, 2,000 feet wall space and floor space to view exhibits. Census Office, 300 feet wall and floor space to view exhibits. The total floor space required is 35,000 square feet.

THE NICARAGUA CANAL.

The President's announcement in his message that a treaty with the Nicaraguan government, which authorizes this government to build, maintain, and forever control a canal, railroad, and telegraph lines across that country, has already been concluded must be both surprising and gratifying to the commercial world. It is a surprise because the negotiations have been conducted to success before any one knew they were being pressed, and gratifying because no more important diplomatic enterprise could have been undertaken than that which has now successfully prepared the way for a water connection between the rich territory of the Pacific slope and the great parts of the Atlantic. From other points of view also the matter is one of great import to the nation.

One hundred miles of the projected enterprise may be reported as almost completed, as it is furnished by the San Juan river and Lake Nicaragua, which is forty miles wide and sufficiently deep for the purpose. The engineering difficulties to be overcome in the remaining fifty-three miles are not great. When this treaty is ratified the Panama question will cease to demand attention—if indeed it shall remain a question.

EDITORIAL NOTES.

THIS number of the REVIEW, like that of December, is conspicuous for its large number of articles by Western contributors. It is also in our opinion exceptionally good in the articles selected from other magazines. The ground covered by these articles is sufficiently wide to meet the wants and sufficiently popular to attract interest, and benefit almost all classes of readers.

We call particular attention to our offers to clubs, and also to the inducements we offer subscribers who desire to subscribe for other magazines.

THE great industries of America form the subject of a series of articles which will commence in the January number of *Harper's Magazine*, with a paper entitled "A Pair of Shoes," written by Howard Mudge Neuhall, a leading shoe manufacturer in Lynn. These industrial articles are planned to give, in readable fashion, a clear idea of how the important articles of industry are made, who make them, how much they earn, and how they live; in short, to inform Americans how they are clothed, fed, and otherwise served in these days of machinery, and how their fellow-Americans earn their respective livings.

WE have received from the author a copy of a new and interesting archæological work entitled "The Book of Algoonah," which attempts to throw fresh light upon the cloudy subject of the Mound-builders. We shall notice it fully in our next number, and in the meantime call attention to the advertisement of the work in this issue.

ITEMS FROM PERIODICALS.

THE January number of the *North American Review* is an excellent one. It presents no very famous names among its contributors,

but it offers a wide variety of unusually readable articles. We are now so safely over the crisis of the presidential election that men of all parties can consider calmly Bishop Huntington's essay on "Vituperation in Politics," and it is to be hoped that what they learn from it will not be forgotten four years hence. Under the title, "The Reunited South," Henry Watterson presents with great clearness the Southern and Democratic view of the political situation as it now stands. This also is extremely interesting to every citizen, whether he agrees with Mr. Watterson or not. Another question of universal concern, which some think will soon make itself a national issue, is that of labor and its compensation; and Col. Hinton, in "American Labor Organizations," shows with what equipment it will take the field. But the article that the literary reader will first turn to is Frederic Harrison's brilliant and incisive discussion of "Froude's Life of Carlyle;" while the religious or philosophical reader will find in Courtney's "Socrates, Buddha, and Christ," specific statements and quotations of those parallel doctrines that are so often vaguely alluded to. For the scientific reader, Mr. Proctor discusses learnedly "Herschel's Star Surveys," and Prof. Le Conte presents and explains some curious facts in relation to "The Evidence of the Senses." Mr. Mulhall's paper on "The Increase of Wealth" is a successful endeavor to render large masses of figures popularly intelligible.

For some months past prospectors have been at work on a coal shaft at St. Joseph, Missouri, having sunk it to the depth of nearly 1,200 feet. As we learn from the *Gazette*, they are now in a dark, oil-bearing sandstone formation and expect to strike oil or coal very soon. All the strata pierced have been found to correspond with those in the coal shaft at Leavenworth, though much thicker. So that the borers expect to find at about 1,235 feet the same vein of coal that has been so profitably worked in the former city at less than 800 feet.

The *Atlantic Monthly* for January, 1885, starts off with a decidedly interesting table of contents: The Prophet of the Great Smoky Mountains, I, Charles Egbert Craddock. A Canadian Folk-Song, William Wilfred Campbell. Childhood in Greek and Roman Literature, H. E. Scudder. The H Malady in England, Richard Grant White. A Marsh Island, I.-III, Sarah Orne Jewett. The Christ of the Snows—A Norwegian Legend, S. Weir Mitchell. A Salem Dame-School, Eleanor Putnam. A Story of Assisted Fate, Frank R. Stockton. Madame Mohl, her Salon and her Friends—First Paper, Kathleen O'Meara. Winter Days, Extracts from the Journal of Henry D. Thoreau. A Country Gentleman, I.-III, M. O. W. Oliphant. The Star in the East, Harriet Prescott Spofford. The New Portfolio, Oliver Wendell Holmes. Vedder's Drawings for Omar Khayum's Rubáiyàt. Culture of the Old School. Recent American Fiction. Studies of the Renaissance. The Contributors' Club. Books of the Month.

The *Popular Science Monthly* presents the following table of contents for January: A Glance at the Jury System, C. H. Stephens. Agnostic Metaphysics, Frederic Harrison. Last Words About Agnosticism, Herbert Spencer. Influences Determining Sex, Prof. W. K. Brooks. My Schools and Schoolmasters, Prof. John Tyndall. Gladiators of the Sea, Frederik A. Fernald (Illustrated). Studying in Germany, Prof. Horace M. Kennedy. State Usurpation of Parental Functions, Sir Auberon Herbert. Bloody Sweat, J. H. Pooley, M. D. Protective Mimicry in Marine Life, Dr. W. Breitenbach. The Chemistry of Cookery, W. Mattieu Williams. Advantages of Limited Museums, Oscar W. Collet. The Architecture of Town-Houses, Robert W. Edis, F. S. A. Mountain Observatories. Sketch of Sir Henry Roscoe (with Portrait). Editor's Table: Harrison and Spencer on Religion; A Healthy Materialism; Politics and Science. Literary Notices. Popular Miscellany. Notes.

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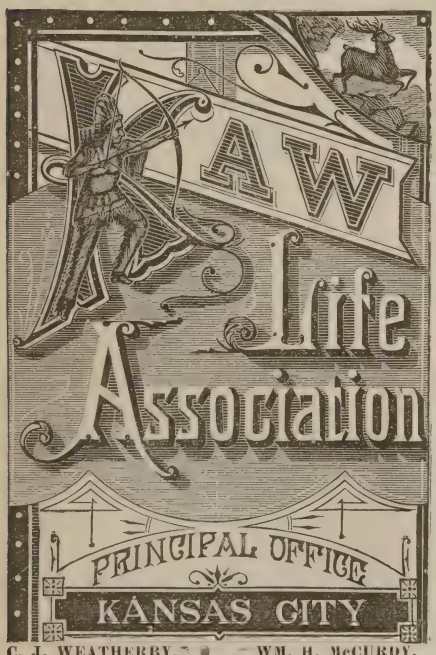
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TABLE OF CONTENTS.

PAGE.

ENGINEERING.

1. The Kansas City Cable Railway.* . . 541
2. Ancient and Modern Engineering and Architecture.* Dr. R. Wood Brown 549
3. Underground Wires. 554

GEOLOGY.

1. The Crawfordsville Crinoids.* Prof. D. A. Bassett 556
2. The Geological Survey of Kansas . . 563
3. The Last Submersion and Emergence of Southeastern Kansas.*—(Concluded). E. P. West . . 565
4. Kansas Scientific Survey. Prof. J. D. Parker, U. S. A. 567
5. The Age of the World.* Rev. L. J. Templin 570

BIOLOGY.

1. The Washburn Biological Survey of Kansas.* Prof. F. W. Cragin . . . 576

ASTRONOMY.

1. Velocity.—III.* Edgar L. Larkin . . 580
2. Cause of Solar Heat. Prof. Richard A. Proctor. 533
3. Sun and Planets for February, 1885.* Wm. Dawson 586

PAGE.

METEOROLOGY.

1. Meteorological Summary for the Year 1884. Prof. F. H. Snow. . . . 587

CORRESPONDENCE.

1. The New Orleans Exposition * . . . 590

BOOK NOTICES.*

1. The Book of Algoonah. Cyrus F. Newcomb & Co 596
2. Catarrh, Sore Throat and Hoarseness. G. P. Putnam's Sons 596
3. Report of the Chief Signal Officer, 1883 596
4. Ninth Volume Wisconsin Historical Collections. 597
5. Progressive Morality. J. Fitzgerald. 597
6. Other Publications Received 598

SCIENTIFIC MISCELLANY.

1. Recently Patented Improvements.* J. C. Higdon, M. E 598
2. Prehistoric Statues 599

EDITORIAL NOTES 600

ITEMS FROM PERIODICALS 602

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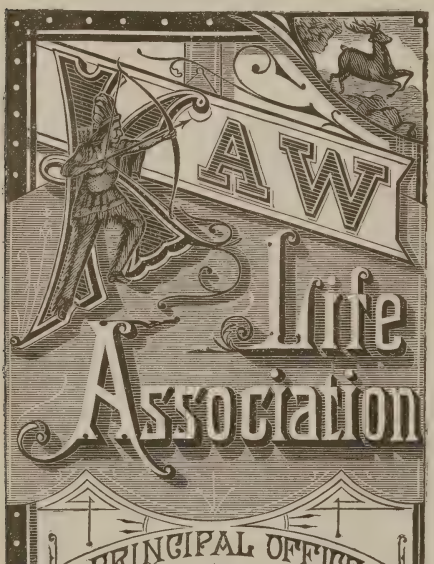
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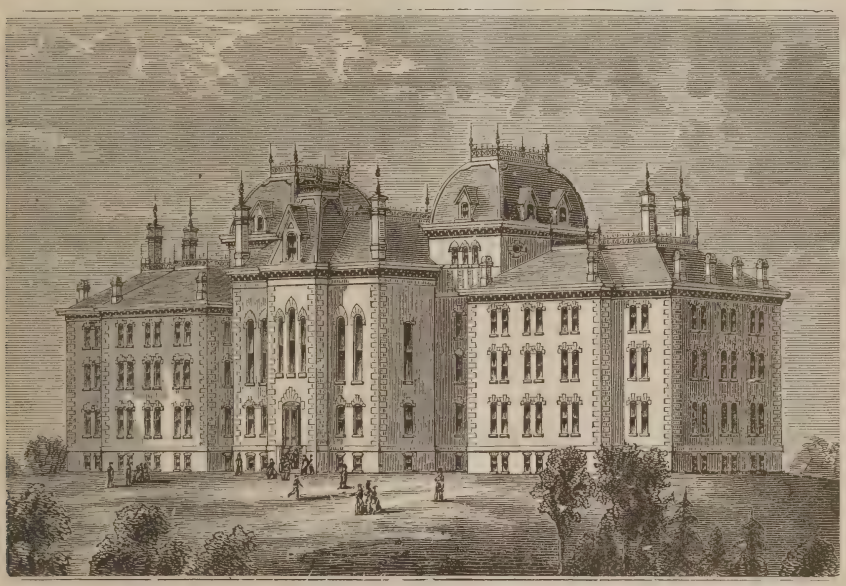
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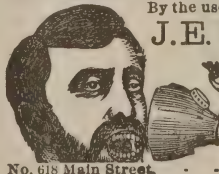
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VOL. VIII. FEBRUARY, 1885. NO. 10.

ENGINEERING.

KANSAS CITY CABLE RAILWAY.

There are now two cities in this country that have cable railways in successful operation, and very soon three others will be added to the list, New York, Philadelphia and Kansas City. The latter city can claim the first duplicate cable railway, the others having but one cable in the tunnel beneath the street for propelling cars. The distinction between a single and double cable in cable railways is what their respective names imply. In the ordinary cable railway, or single cable road, when accidents occur to the cable, such as loosened strands, broken wires or the cable is otherwise injured so as to affect its strength, to repair these injuries it becomes necessary to stop the operation of the road, thus causing a cessation of business which means a very great loss to the company, or which may be prevented only by continuing to use the fractured cable until the hour of stopping at midnight, which would cause still greater injury and perhaps ruin to the cable for further use.

In Chicago when serious accidents occur, the horses used on other lines owned by the company are pressed into service and made to haul the cars. Horses would be of little use pulling cars along the road in Kansas City, as the grades are so excessively steep that it would be impossible to ascend many of them. Should an accident occur, the public would have to wait until the repairing had been done but for the additional cable and machinery that is at all times ready for use at a moment's notice. The change from one cable to the other requires but very little time, and the travel is not interrupted. The duplicate

road has a duplication of machinery throughout. Besides the cables there are two carrying pulleys side by side that support the cable in every pulley-pit, which are thirty-five feet apart along the road; at the extreme ends of the railway, where in the ordinary cable road there is one sheave twelve feet in diameter, in the duplicate road there are two. This duplication is still more extensive in that two independent sets of driving machinery are provided in the engine-house, also engines, boilers, etc.; in fact, the provision made in the way of machinery is sufficient to build another and independent road; thus the cost is very considerably greater than in the case of a single cable railway.

There is probably no cable railway in the country, that in constructing presented so many difficult features to be overcome as the Kansas City road. The wrought-iron elevated structure from Union Avenue to the top of the bluff does not represent all the work done at this end of the road. At Union Avenue large and massive brick foundations were built pyramidal in shape. Old sewers were encountered requiring special provision to overcome these unexpected obstacles. At the bluff very serious difficulties presented themselves. In locating the foundations for the wrought-iron supports for the viaduct it was discovered that a local movement in limestone ledge was taking place. A great portion of earth and loose rock deposited at the base of the bluff was removed, exposing the rock ledge in question five feet in thickness, underneath which was a stratum of soapstone and bituminous shale eighteen feet in depth, which disintegrated rapidly and thus allowed the rock ledge above to fall in large fragments to the base of the bluff. The rock ledge was cleared of earth and other materials, and all the cracks or fissures located, which were then thoroughly cleaned out and filled with liquid cement grout made from German Portland cement. When the cement had set it excluded all water from springs and surface drainage from the base of the rock, which before served as a lubricant to the moving ledge. The shale and soapstone were further protected by building a stone wall in front of the vertical face of the stratum, close to it; the space between the wall and shale was then filled with concrete and cement grout, thus excluding air and water from the exposed face of shale; the rock ledge was thus made solid and permanent, no further movement having been discovered. The process of disintegration of the shale was watched with considerable interest. It was noticed that so long as the shale contained some moisture, or the water was allowed to saturate the surface, disintegration was retarded, but when the sun caused the shale to become dried and warm, the absorbed air seemed to expand, thus throwing off small particles of shale, which would have continued until the whole ledge had fallen but for the protecting wall and the concrete excluding the air.

The wrought-iron viaduct will, when completed, present a very interesting piece of work. The incline down the bluff is eighteen and three-tenths feet in 100 feet and commences at the west line of Jefferson Street with an elevation of 191 feet and descends westwardly, at the rate mentioned, to the center of the main span across the Union Depot yards, the length of which span, from end-pin to end-pin, is 186 feet. The incline commencing in the center of this span,

and ascending with the rate mentioned, caused a curious modification in the design of this bridge from ordinary bridges. The end posts were made to incline so as to cover two panel lengths of the bridge, thus providing sufficient clearance between the portal bracing and top of car, which could not have been secured had only one panel length been covered by the end post as is usual.

From the centre of this span westward to Union Avenue, the tracks are level, beginning at this point to ascend at the rate of two feet in one hundred to and by the waiting station. The waiting station is quite an ornament of its kind. Stairways descend to either sidewalk of Union Avenue, and are covered and protected from the weather. The roof of the main waiting room projects over the platform on all sides, and is covered with slate. A passenger wishing to take a train up the incline to Main street pays his fare to the agent, who gives a ticket in return, which is collected on the train. He passes through the waiting-room to the train. Passengers coming from the trains pass to the passage-way on either side the building, through the gates to the stairways. The trusses across Union Avenue are sixty-five feet in length and eight feet in depth, and three in number, that support the waiting-room and tracks, which trusses are in turn supported by wrought-iron columns, three on each side the Avenue. These columns are inserted into heavy cast-iron shoes or bases, extending into the casting about two feet. The space between the cast socket and column was filled with cement grout and is now equal to rock in hardness. There are two large sheaves, twelve feet in diameter, over the Avenue, supported between the girders, weighing four thousand pounds each. The main bridge span at Union Avenue is supported by two wrought-iron columns, one under the end shoe of each truss. The distance from the railway tracks below the bridge to the floor is twenty-three feet, and the distance from the floor of the bridge to the upper chord or top of truss, is twenty-six feet. The iron work at this end of the road is composed of eleven spans and they have the following lengths, commencing at Union Avenue: 65 feet, 185 feet, 67 feet, 29 feet, 45 feet, 46 feet, 47 feet, 46 feet, 46 feet, 47 feet, 47 feet. At the end of the last span the cable leaves the open work of the viaduct and enters the concrete subway below the street. The rails of the tracks on the viaduct at one point are about fifty feet above the surface of the ground below. The railway is double-track throughout. There are several steep grades on the line, but none greater than the viaduct grade. There are two curves, both at street intersections, at right angles to each other. A special and independent sewer has been constructed from one end of the road to the other, between the tracks, which connects with the regular city sewers at every street crossing. The carrying pulley-pits are made of brick twelve feet by five by five feet in depth, extending under both tracks in its longest dimensions. They are large and spacious. Two cast-iron pulley frames are arranged at each side of the pit corresponding with each track. Communication is had with the pit by means of a heavy trap door between the tracks.

The cable in passing around the curves at Grand Avenue occasions great resistance. The constructions at the curves consist of a series of horizontal

conical pulleys, there being three independent pulleys on each shaft, which constitute a set. The lower one is a large conical pulley having a groove at its base in which the idle cable rests, the next above this is an ordinary horizontal grooved pulley in which the moving cable rides. The next and upper pulley of the set is a plain pulley with a smooth rim against which the grip rests and by which it is guided around the curve. The cable passes from the engine-house to the sub-way below the street and under the south track, thence to Woodland Avenue, around twelve-foot end-sheaves, thence into the sub-way below the north track to Union Avenue, around the twelve-foot sheaves over Union Avenue, and thence to engine-house, around the driving drums and thence to the tension-car wheel, or sheave.

The grip-cars are radically changed from those in use on other roads, in that the grip is operated from the end of the car instead of in the centre, consequently the gripping attachments occupy very little room in the car. A complete cab is provided at each end of the car in which the grip-man is stationed and operates his grip without being interfered with by passengers.

The grip consists of three parts—the upper or crank part, the middle or shank, and the lower or jaws. The upper is made from cast-steel, and so constructed as to embody great strength; the crank and shaft giving motion to the jaw of the grip are connected at one side, this part with the levers of the grip-wheel in the cab, which crank is also connected with the central and moving part of the shank, which has a vertical motion; the moving part of the shank is also connected with the movable and horizontal upper jaw of the grip, the shank being made from rolled-steel and the jaw of cast-steel lined with brass, reducing the wear on the cable to a minimum. The lower jaw of the grip is stationary, having two rollers placed vertically at each end of the jaw. When it is desired to start a car the grip-wheel in the cab is turned to the right, which forces the movable upper jaw (seventeen inches long) down on the cable resting on or rolling over the pulleys in the lower jaw of the grip; the pressure forces the rollers down a limited distance with the cable; as they are supported by flexible journals, the brass in the grip takes hold of the cable under the pressure of the grip-wheel and the car moves. If it is desired to stop the car, the grip-wheel is turned to the left, thus raising the movable upper jaw from the cable. The pressure being released, the small pulleys in the lower jaw spring upward slightly and support the cable, revolving at the same time, and while the car is thus stayed, receiving or discharging passengers, the cable continues to move through the grip between the jaws supported by the pulleys referred to. It does not matter how often stops are made, the cable never leaves its position between the grip's jaws—it is either gripped by the jaws or riding on the pulleys in the lower jaws. The cable is, however, conducted out of the grip when it is necessary to change the car from one track to another, and in passing over the vault on the south track at the engine-house—there being no cable at this point, as it is conducted into the engine-house too far below the street for the grip to reach—the cars are carried

over this distance, which amounts to forty feet, by momentum acquired from the cable before reaching the vault. This occurs on the south track only.

The cable is one and one-quarter inches in diameter, made from Swedish iron wire. It is capable of resisting a strain of thirty tons. There is a total length in both cables of forty-four thousand feet. It is expected that this cable will have to be replaced within eighteen months from the opening of the road.

Many people have been at a loss to know how the cable is prevented from impinging against the upper side of the tube or tunnel below the street in the depressions along the line, and at points where grades change from a level to a comparatively steep grade. It must be remembered that the cable is very much heavier than a string, its weight being two and a half pounds per lineal foot. When the ordinary tension is on the cable and an average number of grips with their loaded cars attached are being propelled by it, the deflection between the carrying-pulleys, which are thirty-five feet apart, is about two inches. It would be impossible with any power to cause the cable to assume a straight line from one hill to the other, and before the *sag* or deflection could be gotten out, it would break in two. The cable leaves the engine-house with a strain of about one ton and returns to it with about five tons (approximately), doing its maximum work, and the total weight of one cable is about twenty-eight tons, Where it is necessary at the depressions referred to depression-pulleys are placed which hold the cable down, and when the grip passes the cable is pressed down six inches below these pulleys; thus the grip avoids contact with them.

The maximum grades on various roads are as follows:

Clay Street, San Francisco	16	feet in	100 feet.
California St., "	18	"	100 "
Suter St., "	8.7	"	100 "
Geary St., "	9.8	"	100 "
Ninth St, Kansas City	18.3	"	100 "
Chicago City, State St	(about level.)		

The power developed in operating cable railways is usually proportioned as follows:

For moving cable	51 per cent.
For moving cars	46 "
For moving passengers	3 "

The power-station or engine-house is located at the corner of 9th and Washington Streets, and has a frontage on the latter street of ninety feet and on the former of 144 feet, two stories and basement. The east room is the boiler-room, and is separated from the engine-room by a brick partition wall; the floor is thirty-two feet below the street grade. One battery of boilers, after the Ferminicle patent, twenty feet in height, occupying a floor space of twelve feet by twenty feet, have their fire fronts facing 9th Street. The boiler settings are especially attractive, being laid up with Philadelphia pressed brick, with a bold projecting

cornice. In the use of these boilers there is no danger from disastrous explosions, as is the case in the use of ordinary tubular boilers. At the base on either side and a little below the grate-level are two large plate-iron mud-drums, the upper sides of which are framed with a horizontal plate, into which the water-tubes are expanded; the tubes are sixteen feet long and three and a half inches in diameter, and are placed in an inclined position, the ends being expanded into the lower horizontal plates of the upper water drums. There are two of these drums in each boiler corresponding with the lower mud-drums, the tubes in these drums incline towards each other as they extend upward to the water-drums above; above these drums the steam-drum is located, connected with the upper drums referred to by means of two wrought-iron legs six inches in diameter. The water circulates through the tubes, the heated gases passing around and about them. In the case of low water there is no danger of explosion save from the three and a half inch water-tubes, which would result in no serious damage should any explode.

Immediately back of these boilers is located the smoke-stack, and south of this again is another battery of boilers. The smoke-stack pedestal is eighteen feet square, and the total height of the stack 150 feet above the boiler-room floor, the flue is five feet in diameter, having an iron ladder fixed at one side of the flue from the base to the top of stack. Directly west of the stack and against the wall, is arranged a large heater with pumps and other necessary parts. The heater containing water has a height of twenty feet and is fifty inches in diameter, having inverted (∩) U-shaped brass tubes. On either side the heater are Worthington Duplex Pumps, each having a capacity of 8,000 gallons per hour. The exhaust steam-pipe from the engines conducts the steam to the heater, which then passes through the inverted U-shaped brass tubes in the water in the heater, thence by the exhaust-pipe out of the building.

It will be seen that in this, as in all heaters, the steam after having performed all the work required of it in the engines in turning the machinery, is conducted throngh the heater, thus heating the feed-water to a temperature of about 280° ; when it is forced by the pumps into the boilers. It is generally claimed that fifteen per cent of fuel is saved by using a good heater over the practice of forcing cold water into the boilers. The total boiler capacity equals six hundred horse power.

The engine-room, which is twenty feet above the floor of the boiler-room, has the appearance of some large pumping-station. There seems at first glance to be a confusion of large drums and gear wheels which, upon closer examination, assume right positions and perform each their respective work. To those expert in mechanical construction it presents a very complete and well arranged picture of accurate designing, nicely proportioned parts, and upon the whole a model plant for the purposes for which it was designed. There are two large automatic cut-off engines quite near the door through which you pass in entering from the boiler-room. The cylinders are 24x48 inches. The engines throughout are highly finished and were built by William Wright, of Newburgh, New York. In place of the ordinary crank, large and highly-polished circular discs are arranged,

which add much to the engines. The engines combined are equal to five hundred horse power.

The engines are about twenty feet apart, having a common shaft thirteen and a half inches in diameter. On the end of the shaft nearest the east engine the large driving-wheel is fixed; it is eighteen feet in diameter, weighing 34,500 pounds. A very heavy and substantial pillar-block supports the shaft between the fly-wheel and the large gear on engine-shaft. This gear has an eighteen inch face, and is geared into a large gear ten feet in diameter, keyed on the main-line shaft of driving machinery. A very heavy cast-iron girder-frame surrounds the gear referred to. The main-line shaft extends westward across to the girder-frame of driving machinery. This frame entirely surrounds the driving machinery and is eighteen inches in depth and seventeen inches across the upper face. Between the two outside parts of the girder-frame there is arranged a central piece running north and parallel with the outside frame. On each of these three parts of the girder-bed or frame of the machinery, and supporting the main-line shaft, are heavily proportioned pillar blocks. Next the two outside pillar blocks the five-foot gears of the machinery are keyed on a sleeve on the main shaft, which shaft revolves in the sleeve, each of which have a sleeve arranged on their inward side. In these sleeves eight steel circular plates are permanently fixed. Another sleeve is keyed on to the main shaft, which also has eight circular steel plates arranged which revolve with the shaft, but which are worked laterally on a key in the shaft. When the sleeve is moved inward with its steel plates, the plates take up against the steel plates in the sleeve on the gear, causing frictional contact, which is gradual but positive, and when the plates are brought together with sufficient pressure the gear revolves with the main driving-shaft. These gears are connected with a series of gears, which cause the two driving drums twelve feet in diameter of each set of driving machinery, around which the cable passes, to revolve. The central piece of girder frame separates the two sets of machinery, either of which is set in motion or deprived of motion by means of the lever connected with their respective clutches described above. These clutches are known as the Weston Clutch and are the largest of the kind applied to this class of machinery.

When accidents occur to the cable and it is desired to repair it, the clutch belonging to that particular set of machinery is released, and the other is forced against the gear plates of the other set of machinery; thus the other cable is set in motion, doing the work of the injured one until it is repaired. The injured cable is then, by means of auxiliary engines, slowly led into the engine-room where the repairing is done.

These auxiliary engines, especially designed for this purpose, were built by the New York Steam Engine Company. The driving machinery was made by Poole & Hunt, Baltimore, who have a national reputation for manufacturing the finest gears and machinery of this character.

Back of each set of driving machinery there is a track built which extends five feet above the floor of the engine-room, and supported by a series of brick

arches. Upon this track a car moves back and forth, moved back by means of heavy weights in a pit at the back part of the building connected with the car by means of a cable over a vertical pulley at the pit, moving forward as the increased tension on the cable in the street demands, caused by additional cars using the cable. There is arranged also in the center of this tension-car a large twelve-foot sheave which constantly revolves as the cable passes around it, in going from the driving-drum to the sheave and out into the street again. The gauge of the tension-car track is three feet. In front of the engine-house on 9th Street a very large vault is made under the street; the roadway at this point is carried by iron columns. This vault has six large twelve-foot sheaves arranged in it, each of which weighs 4,000 pounds; these are used for directing or guiding the cables in to the engine-house.

The room next west of the engine-room is arranged as a machine shop; it is large and provided with such tools as work of this kind requires.

The 9th and Washington Street floor is used as a storage-room for cars, in one corner of which is provided a very complete wash-room for cars, heated in winter with steam radiators, and also provided with hot water.

The upper floor is used as a paint and repair shop, except that portion partitioned off for offices. These offices are all finished with Southern pine, there being in all six rooms; namely, conductors', superintendent's, cashier's, directors', and civil engineer's office.

The total length of this road, as now built, is two and one-quarter miles. Next summer the road will be extended eastward one mile on Independence Avenue, and one mile on 9th Street. Mr. Robert Gillham, C. E., chief engineer of the company, has his plans of these extensions nearly completed. Plans are also being prepared by Mr. Gillham, who is also chief engineer for the Inter-State Rapid Transit Company, who are about building an elevated cable railway from Kansas City to Wyandotte. The total length of this road, including the proposed surface cable railway through Wyandotte, will be three miles, making a total length of double track, when these extensions are completed, of seven and one-quarter miles, all of which road will be operated by the machinery and the cable that operates the Kansas City Cable Road, described above.

There has been very little reliable information gathered regarding the economy and the power required under different conditions of loading of cable, to operate these roads. While it is true that cable railways have been in operation in San Francisco for several years, no scientific records or tests have been made; thus the results are not very well determined.

Mr. Gillham has provided means of testing the capacity of boilers, power of engines, evaporation of water per pound of coal, power required to move cable, machinery and cars; also to test power required in ascending the various grades, and to test the tension on cable under all conditions of loading. The information gathered from careful tests of this character will be of value to the engineering profession.

ANCIENT AND MODERN ENGINEERING AND ARCHITECTURE.

DR. R. WOOD BROWN.

The remark, "there is nothing under the Sun," is more axiomatic than the casual reader believes. We think that this is a very progressive age and that our generation stands pre-eminent in civilization—is the highest known. This is so, but to state that we, in this age, are immeasurably superior to the ancients is, we think, incorrect. Our aim is not to prove our century inferior to the past ones, rather it is to present historical facts which will indicate that mordern architectural and engineering works are merely reproductions of those of the ancients, though sometimes larger and more speedily erected, owing to better facilities.

The works of long ago compare very favorably with those of the present, and in some instances excel anything of our own time. Hardening copper for tools is one of the lost arts; we cannot manufacture the Damascus blade, nor do do we know by what means the pyramids were erected. There are very few (if any) streets like one in Cordova founded 152 B. C. It was perfectly straight, ten miles long and illuminated by public lamps. Paris, which is said to be the best lighted city in the world, cannot surpass this wonderful street. Cordova was not without rivals. Granada, founded before Augustus; Seville in its prime 590 B. C.; Toledo taken by Maximus Flavius 193 B. C., vied with Cordova with its 200,000 houses and 1,000,000 inhabitants. This city of Cordova may not be a fair comparison, as its decay commenced when conquered by Ferdinand III. of Castile in A. D. 1236. Modern cities surpass the ancient in number rather than in magnificence.

A slight acquaintance with archæology is sufficient to show us that the Statue of Liberty Enlightening the World is a duplicate in principle of the Colossus of Rhodes. The former is to be erected upon Bedloe's Island in New York Harbor, in honor of fraternity between France and the United States. It is of copper and the ascent to the head is made by inner stair cases. The right arm is extended, grasping a torch which will illuminate the harbor by electricity. The total height is 328 feet 11 inches, pedestal 177 feet 9 inches, leaving 151 feet 2 inches for the statue. This work of art was fabricated in France under the supervision of its projector, Bartholdi, who, in all probability took his idea from the Colossus of Rhodes, which was also erected upon an island, the Rhodus, in the Mediterranean Sea twenty miles from Lycia on the south coast of Asia. This Colossus was of brass, and erected 300 B. C. in honor of Apollo. Historians tell us that the height was 125 feet, "with legs distended on two moles which fromed the entrance of the harbor," said moles supposed to have been twenty feet apart, and ships sailed under the body on entering the port. The statue was hollow and the legs were lined with large stones to counterbalance the weight. This Colossus was the workmanship of Chares a pupil of Lysippus, a celebrated sculptor of Greece.

The Colossus of Rhodes was thrown down by an earthquake sixty years after erection. The brass made 900 camel-loads, or 720,000 pounds.

The Washington Monument, is considered a grand work, but the work of putting a new foundation under the old one was far more wonderful than the building of the obelisk itself. (See Kansas City REVIEW OF SCIENCE AND INDUSTRY, January, 1885, page 501). This monument presents a smooth exterior and is 555 feet in height; was commenced more than thirty-six years ago and finished under Colonel Thomas Lincoln Casey, chief engineer and architect, December 6, 1884. This pile of stone is hollow and capped by marble with a conical apex of aluminum. The Pharos of Alexandria was 450 feet high and built upon an island. Alexander the Great gave his order for this structure 332 B. C. to a Macedonian architect, Dinocrates by name, who also connected the island with the mainland by an earth wall. This light-house differed from the Washington Monument in being highly ornamented, the stone was finely carved, columns and balustrades worked in the finest marble embellished the exterior. It was built in several stories, tapering towards the top. The ground floor and the two next were hexagonal; the next square, with towers at each corner; the fifth to the top was round, with an exteral winding staircase. The extreme top was open so that sailors could see its night beacons. The Pharos at Alexandria was a work of art, a credit to Alexander who commenced, and to Ptolemy Philadelphus who finished it. The Americans have built the highest structure known to man, but it is barren of all art. There is quite a difference between building a lighthouse with carved marble on an island, and erecting huge stones perfectly smooth by machinery, inland, even to the height of 555 feet.

Both ancient and modern engineers and architects considered height as a great objective point. The great Pyramid is 478 feet. Cologne Cathedral is 510 feet. Rouen Cathedral 490 feet. The statue of San Carlo Borromeo, at Arona, erected in 1697 was 66 feet high and the pedestal 40 feet. A marble statue of Nero was said to be 120 feet high. The walls of Babylon were 378 feet high, also 93 feet 4 inches thick and in compass 60 miles. Herodotus, who was at Babylon, gives these figures; others give the height 50 feet as they were after the time of Darius Hystaspes, who pulled them down to that height, that he might conquer the city again more easily, if necessary. The Chinese wall was much longer, being 1,250 miles, but very much inferior in width and height; only 20 feet high, 25 feet wide at the base and 15 feet at the top; about one-third of the wall of China is dirt and rubbish, the rest being masonry, and it dates back to 220 B. C.

The Hanging Gardens of Babylon were built by Nebuchadnezzar to gratify his wife Amytis. The gardens were over 400 feet square, built terrace above terrace until they were 27 feet higher than the walls, or 400 feet. The top was sustained by a series of arches one above the other and each terrace was bound by a solid wall 22 feet thick. On the top arches were first laid flat stones 16 feet by 4, over these weeds and bitumen; then two rows of cemented brick covered

by sheet lead, upon which was laid earth sufficiently thick to nourish large trees. The gardens were filled with the blooming plants and shrubs which were admired by Queen Amytis in her native Media. The different terraces and groves contained fountains, parterres, seats and banqueting rooms; in fact all the splendor and magnificence of eastern art seem to have been lavished upon these gardens by King Nebuchadnezzar in order that his Median bride should be happy in her new home. Pen cannot picture the grandeur of the conception or the perfection of the execution of these gardens, which have been and are the wonder of all ages. The greatest hanging structure now in existence is the Brooklyn suspension bridge, costing $15,000,000. The whole length is 3 475 feet, and it connects New York and Brooklyn by a clear span of 1,595 feet. It is 135 feet above low-water mark and 85 feet broad, it has also two platforms, one above the other. The piers are stone masonry, hollow and sunk below the surface by means of caissons. As the details of this work are formidable it is sufficient to say that it is the greatest engineering feat known. John Roebling was the engineer.

One of the mysteries handed down to us is the manner in which the ancients manipulated these immense stones. Take the obelisk of Luxor, which stands sentinel over the Place de la Concord, in Paris, seventy-three feet in length. Long-continued manual labor could quarry it, but by what means it was conveyed to Luxor is still hypothetical; and the stones of the Pyramids, not one of which is less than thirty feet long by five thick, how could they be hoisted up 478 feet, or rather, how were they, and by what means were these great blocks of granite transported from the quarry at Syene to the delta of the Nile, a land journey of six hundred or a voyage of seven hundred miles? Egyptologists have surmised many ways by which the Pyramids were built, but none of them seem satisfactory. No representations of derricks or hoisting machines have been bequeathed to us. Some writers say that the stones were raised by machines from step to step, others tell us that skids were used, still others that the external covering was laid from the top to bottom. The great Pyramid Cheops covers at base about 550,000 square feet and rears itself 478 feet. The first step is nearly four feet eight inches high, the top one one foot eight inches. Mathematics were known in that day, as its angle was perfect at all sides 51° 50′, also each stone was accurately fitted to another. Notwithstanding the difficulty in finishing granite the stones of this royal tomb were finely polished. Chronologists differ as to the date of the reign of Cheops, the latest date given being 2123 B. C. Herodotus says that he "was informed by the priests of Memphis that the great Pyramid was built by Cheops, that 100,000 men were twenty years in building it, and that the body of the king was placed in a room in the bottom of the Pyramid." No king ever had a mausoleum so beautifully magnificent; beautiful in its simplicity, magnificent in its proportions. The Pyramid of Aphren is 684 feet square and 456 feet high. The Pyramid of Mycerinius is 330 feet at base and 174 feet high. There were many other pyramids built, but to all of them we can only say "the eternal pyramids—the mystery of the past—the enigma of the present—and the enduring for the future ages of this world."

We have never felt the feebleness of our descriptive powers so keenly as in the preparation of this paper. We have seen some of the works of the past, and their impressions can never be obliterated from our mind. We have seen the magnificent Cathedral in Milan, have seen the sun's rays reflected from its white marble, towering up 358 feet; we have watched day after day the light and shadow creep over its 10,000 statues, 1,500 bas reliefs, and its 136 spires. We have wandered over its variegated marble floor 486 feet long and 288 feet wide, and have climbed wearily to the top, yet we have no power of description—no delineation can convey our ideas adequate to the effect in viewing this stupendous church, begun in 1387, March 15th, and yet unfinished, costing so far $110,000,000. The Temple of Diana, at Ephesus, has been graphically described by archæologists and we cannot do better than to gather bits of their brilliant pen pictures. The original object of worship in Ephesus was a small statue of Diana made of ebony and believed in those days to have been sent down from heaven by Jupiter. A temple was erected to contain this image and completed during the reign of Servius Tullius 570 B. C. This temple was said to have been destroyed by fire. A second one was commenced about 540 B. C. exceeding the first in splendor, and this was partially burned on the day Socrates drank the hemlock 400 B. C. After having been restored with greater grandeur it was again partially burned 356 B. C. on the night Alexander the Great was born. Materials saved were sold, women gave up their jewelry, and contributions were sent from all parts of Asia, amounting to an immense treasure, and thus the Temple of Diana was restored in all its magnificence. Pliny says "that to secure the foundations of the conduits and sewers which were to support this structure, there were laid beds of charcoal, well rammed; over them wool; and that 220 years elapsed before this grand temple was completed." It was 425 feet in length and 220 in breadth, supported by 127 marble Ionic columns sixty feet high, of which thirty-six were richly sculptured and fhe rest highly polished. Each column was a gift of a king. The building and courts were encompassed with strong walls, there was a court on each side of the temple which was built upon a series of narrow arches one within another. The site being a morass, the foundations were said to have cost more than the superstructure. This magnificent work of art is no more, but if we should visit Constantinople we would find the Church of St. Sophia raised upon some of these columns given by kings to the goddess Diana. Justinian also filled Byzantium with statues from Ephesus.

One thing the ancients did not attempt; at least there is no record of their building self-supporting domes prior to the church of St. Sophia, in Constantinople, originally built by Constantine, destroyed by fire, and rebuilt by Justinian. The dome is 175 feet high. St. Paul's, London, commenced in 1675 and finished in 1710, has a dome 145 feet in diameter, and 365 feet from the ground. St. Peter's has the largest and highest dome known. This beautiful pile was commenced in A. D. 1450, and finished three and a half centuries after. The dome is 405 feet from the pavement and 193 feet in diameter. The domes of the churches of St. Genevieve and Invalides, Paris, are also self-supporting.

Not even Dinocrates, who built Alexandria and the Pharos, also the Temple of Diana, attempted the difficult engineering feat of self-supporting domes. In constructing the Pyramids mathematics were known, consequently it was not ignorance which prevented the ancients from worshiping under a self-supporting vault.

The sewers of Paris are great works of skill, large enough to float inspection-boats, but they do not surpass very much the Maxima Cloaca of Rome, thirteen feet broad and thirteen feet high, built by Tarquinius Priscus, 616 B. C. Athens had sewers which drained into the Saronica gulf. Babylonian sewers drained its marshes into the Euphrates. Modern age has simply copied from the ancient. The principle is the same now as when the Alexandrian architect wished to build a temple to Arsinoe, in which he intended to suspend her statue by means of a lodestone. The only thing modern sanitation can claim over the ancient is sewers greater in length and number, owing to the greater needs.

Of aqueducts, the Croton of New York claims the honor of being the finest of our age. It is forty-two miles long and thirty-three from Croton lake to Harlem river. Lisbon aqueduct is twelve miles long; the one which carries water to Paris 110 miles. Ancient Rome had fourteen aqueducts. Three of these supply modern Rome, Aqua Virgo, about eleven and a half miles, built by Agrippa, to supply his baths. Aqua Claudia, forty-five miles long, and Aqua Trajana, twenty-three miles, built to supply inland basins for spectacular sea fights. Constantinople had its aqueduct of Pyrgos fifteen miles long. The aqueduct supplying Athens had perpendicular pipes of clay or lead every 240 feet or so, leading up to the surface; by this contrivance light and air were admitted to the water. Eupalinus tunneled through a hill at Samos eight feet high, eight feet broad, and four thousand two hundred feet long, with an accurately-reckoned declivity; also a channel at the bottom, three feet square, to carry the water, which was thereby aerated. Duplication of tunneling on a greater scale is found in Mt. Cenis eight miles long, double tracks. It is twenty-five feet wide at the base and twenty-four feet high. St. Gothard is nine and a half miles long. Hoosac is 25,040 feet, and Sutro 3.84 miles long. The last clearly parallels the Samos tunnel, being used to carry water from a mine. Some writers say that the Euphrates was tunneled under, but the statement is vague and bears no authenticity.

The reservoirs of the ancients were not inferior to those of the present time. The expertness of the ancient engineers is attested by the remains extant; they certainly are not buried in the waters of the Lethe. The Pools of Solomon still continue to furnish water to Jerusalem. They are three in number. The upper is 160 feet above the middle one, the latter 248 feet above the lower. The first was supplied by pipes from springs, and, when full emptied into the second and that into the lower one. The water was used for irrigating Solomon's gardens and supplying his temple. The lower pool held about 31,442,425 gallons, the middle about 12,289,912, and the upper one contained 13,778,772—a grand total of 58,511,109 gallons, or nearly six times as much as the Kansas City reservoir, which is estimated at 10,000,000 gallons. These pools were solid rock and

masonry, lined with cement, and had steps leading to the bottom. One historian says that Nebuchadnezzar, wishing to brick the bottom of the Euphrates, which flowed through the center of Babylon, caused a reservoir forty miles square to be dug so as to allow his masons a dry river bed. Another historian writes that Nitocris, a daughter of Nebuchadnezzar, is said to have dug a reservoir 420 stadia in circumference, lined with stone, for the waters of the Euphrates, in order that the river-bed at Babylon should be dry so that she could build piers for a bridge. A stadium being 625 feet, it would make this circumference forty miles. These two reservoirs may be the same, and this shows what discrepancies there are among writers.

The melting snows from the Armenian mountains sometimes caused an overflow of the Euphrates, whereby the city of Babylon and the country surrounding suffered from inundations. It was therefore necessary to drain the country, and to prevent any future trouble two canals were cut west from Bossippa to the river Tigris, which makes these canals about seventy-five miles long. Ancient Greek authors attribute this work to the ruler who made the greatest city of ancient times and one never excelled in any age—Nebuchadnezzar. There are many canals now of modern engineering, but few, if any, constructed to drain and to receive waters from overflowing rivers. The longest canal is the Erie, in New York State, 350½ miles long and 70 feet wide, finished in 1862. The largest canal is the Suez, authorized by Said Pasha in 1854, built by M. Ferdinand de Lesseps, and finished, or rather, officially opened in 1871. It is 100 miles long, of which 25 miles are lakes. Its width varies from 325 to 197 feet at the top, and is about 70 feet wide at the bottom; the depth varies from 30 to 85 feet. The Erie canal entire cost nearly $46,000,000, while the capital stock of the Suez company was $60,000,000. The United States leads all other nations in number of canals—forty-four altogether.

The length of this paper forbids our writing further, although the archæological fields are blooming with undescribed beauties of art. Many more comparisons could be made which would place the modern age in an unenviable position. Readers who have been our companions so far will notice many so-called errors, but when it is borne in mind the large number of historians and archæologists, also the difficulty of deciphering the writings of those whose sarcophagi have been violated, it will be apparent that dates and measurements, at the best, are merely approximate.

KANSAS CITY, MO., January 21, 1885.

UNDERGROUND WIRES.

Representative Bond of St. Louis has introduced in the Missouri Legislature a bill providing for the removal of all telegraph, telephone and electric light wires from poles and buildings to channels under ground.

It provides that no person or persons, or company, or corporation shall be

allowed to erect or maintain on telegraph poles, piers, abutments, wires or other fixtures upon, along or across any of the public roads, streets, and alleys of any city having a population of over 100,000 souls. The companies will be given one year after the passage of the act to take down their poles and wires, the penalty for the maintenance of such after that time to be the payment of $1,000 a day into the State Treasury until the poles and wires have been taken down. Mr. Bond says that wires are now being put under ground in Chicago, as they have been in New York and Philadelphia, and that his bill will be similar to the one passed by the New York Legislature, and decided as valid by the Supreme Court of that State.

We find in the *Globe-Democrat* the following article, which doubtless expresses the popular feeling upon this subject:

New York has a law ordering that all telegraph, telephone and electric light wires in New York City and Brooklyn shall be put under ground by the 1st of next November, or else be torn down by the city authorities. The passage of this law last spring filled the managers of the electric companies with consternation, and they have from time to time been loud in their protestations of inability to conform with the order, though professing themselves to be only too anxious to have some feasible method of doing so. The honesty of these declarations receives a severe shock now from two eminent experts in electricity. Prof. Bell, who invented the telephone, not only believes that every city ought to insist upon the burial of telephone wires, but says that the service would thus be greatly inproved; while Sir William Thomson, in an elaborate report upon the telegraph service, affirms as the result of his experiments that "there is no doubt whatever that any amount of traffic could be worked through a system of underground wires at the usual rates of hand sending." Nor, he adds, "is it any more difficult to work lines composed partly of underground and partly suspended wires. The cost of maintaining underground wires would compare favorably with that of aërial lines, though the first expense would of course be vastly greater. But, on the other hand, "underground wires will be almost free from interruptions due to storms or to extremes of heat and cold, whereas aërial lines, however well constructed, must always be subject to injury from wind, snow and extreme cold."

These opinions are worth emphasizing because the subject is being mooted in almost every city of importance in the land, and is everywhere met by the electric companies with the same profession of helplessness. Of the desirability of the change there can hardly be two opinions. The forests of wires which fill many of the streets of every city are not only an offense to the sight, but a source of annoyance and frequently of danger. They present one of the confessed hindrances to the best efficiency of the fire department service, and in the case of electric light the wires are a constant menace to property and life. Cases of death and of the burning of buildings from contact with the electric light wires are not unknown and electricians have testified that this danger is by no means small. A storm which throws the wire to the ground might easily make it an instrument of death; a stream of water from a hose-pipe striking an abraded insulation

might kill a fireman; or a wet flag-pole jutting out from a house might serve as the conductor for a devastating current. In fact, security in the case of the electric light wire, depends upon keeping intact a slight covering that is swayed by every breeze.

The subject is, however, one of indisputable difficulties, particularly in cases where, as in the telephone, single wires are conveyed for considerable distances, and the income from them is of necessity small. To insist that every telephone wire shall be placed underground would, under existing conditions and until this modern luxury is much more generally enjoyed, frequently amount to prohibtion. It is becoming a serious question, too, how far it is advisable to carry the system of underground communications in the streets. What with sewer, water, gas and steam pipes, the streets of many cities are being pretty constantly dug up, to the obstruction and even prevention of the travel which is their principal office. Perhaps the solution of this complex problem may one day be the adoption of a general and uniform system of underground communications, like a common subway which shall contain all the appliances for distributing heat, gas and electricity, and shall be of sufficient size to permit of ready access for additions or repairs. The cost of such a system would, doubtless, be very great, but it would settle the problem once and for all.

GEOLOGY.

THE CRAWFORDSVILLE CRINOIDS.

PROF. D. A. BASSETT.

About thirty-five years ago, the students of Wabash College in their rambles along the bluffs of Sugar Creek, not far from the town of Crawfordsville, were greatly delighted with beautiful little cavities which they discovered in pieces of rock picked up or pulled from the loose shale of the bluff. These cavities resembled moulds of beautiful flowers. There was the impression of a slender stalk, a calyx singularly marked with rows of little dimples, and a corolla of long slender petals with delicate pinnate fringes. These were impressions left in the rocks by fossil crinoids whose decayed remains had been washed away.

As I am informed, the first crinoid found in this locality was picked up by Rev. H. C. Hovey, at the time a student in Wabash College. This specimen, however, differed so much in form and appearance from the beautiful impressions alluded to, that it suggested reptiles rather than lilies, and hence was labelled, "a petrified toad" by this young scientist, who has since won for himself much honors among the caves.

The deposit from which the crinoids were taken, is situated in the bluff on

the right bank of Sugar Creek, one mile north of the city of Crawfordsville, Montgomery County, Indiana. It extends up and down the creek a distance of about thirty rods, cropping out towards the northeast, and pitching under the creek towards the southwest. How far it extends into the bluff is not known, but probably not very far. This small space of four or five acres seems to be the only spot in Montgomery County where these fossils are found, and the only one in the world where they are found in such abundance, and in such favorable conditions for excavating and preparing them for the cabinet. For some reason this seems to have been a favorite locality with these remarkable animals of the carboniferous seas.

Geologically, the beds belong to the Keokuk Group of the sub-carboniferous period, and are composed of argillaceous shale, loose and much broken at the top, but more compact and solidified below. The rock is stratified, and indicates aqueous deposit in quiet waters. In color the strata resemble French gray, or light lead color tinged with blue. The upper strata for several feet have been bleached to a light brown by infiltrations of the surface-water. The strata vary in thickness from one to three feet, and the hardest of them, owing to their shaly character, may be quite easily split into slabs of various thicknesses.

Remains of crinoids and other fossils, decayed and worthless, are found quite abundant at the very summit of the shale, and continue to the depth of fifteen feet. The next twenty feet are almost entirely destitute of fossils of any kind, and the cessation of life above and the beginning of life below are very abrupt. The first crinoids, sufficiently well preserved for cabinet collections, are found at a depth of thirty-five feet from the top of the bluff, and most of this distance the rock must be blasted. Below this point, crinoids have been found at different intervals as far as excavations have been made. They do not occur in all the strata, neither are they uniformly scattered through those in which they do occur. For the most part they seem to have lived in schools, or clusters, sometimes crowded so closely together as to be lying one upon another five or six deep. In a slab measuring three feet by two and a half, taken from one of these clusters, and the matrix so removed as to expose the fossils in their natural position, there were eighty crinoids besides several other fossils of different genera and species. The crinoids with their curious heads, and their long stems crossing and recrossing each other, lay stretched out one above another in every direction. Among the crinoids in these clusters are frequently found mollusks, trilobites, conularia, archimedes, pentremites, ongchasters and protasters, and some others, strangers to the writer.

These clusters usually extend but a few feet, and generally terminate abruptly, and where another such shall be found, is a matter of chance, involving much time and hard labor. An occasional crinoid, usually of larger size and more perfect than usual, may be met with in the intervals between these clusters, but in the intervening spaces between the bearing strata, which vary from one to several feet, we may look in vain for any crinoids fit for the cabinet—nothing but fragments of heads and stems, evidently the work of mollusks.

The crinoids from the Crawfordsville beds are remarkably well preserved. They are evidently lying just where they lived, died and were buried in the ocean ooze thousands of years ago. During all these ages, they have remained undisturbed, so that the finest markings and most delicate tentacles and pinulæ are perfectly preserved. And such is the nature of the matrix in which they are imbedded, that with sufficient care, patience and skill, they may be so removed as to restore the animal with all the parts entire. Such specimens are not only very beautiful, but they also afford the very best opportunity for studying the structure, nature and habits of these animals.

It must not be inferred from what has been said, however, that all the specimens obtained in these beds are perfect. So far from this being the case, probably not more than twenty per cent of the heads found are perfect, while an *entire* crinoid, head, stem and root, of the larger species, is so seldom met with, that the author in all his excavations, extending through several years, has never found but one. That may be seen among the many other rare specimens, in the museum of Wabash College.

For more than two hundred years crinoids have occupied the attention of scientists. During that time they have certainly received their full share of attention. Agassiz tells us that up to his time not less than three hundred and eighty authors had published their investigations upon the crinoids, and that the books printed about these animals would furnish a library in themselves. And to this we may add, that there are many questions connected with the subject still unsettled.

The perplexity concerning the true nature of the crinoid commenced in the sixteenth century. Small, round, flat stones with holes through them, and impressions of little stars upon their sides, excited great curiosity. "What are they?" was the question. The common people called them pulley-stones, and St. Cuthbert's beads, and wore them for ornaments and used them for rosaries. Scientists, puzzled and perplexed, called them *trochites*, from the Latin trochus, a wheel. In process of time, beautiful impressions were found in the rocks, much the same no doubt, as those found by the students of Wabash College along the banks of Sugar Creek. These were supposed to represent fossil plants, and what name more appropriate than *Crinoid*, from the Greek *Krinon*, a lily. In process of time, this idea of the nature of the crinoid was still farther confirmed by the discovery of a single specimen from Porto Rico, "described," as Professor Louis Agassiz tell us, "by the naturalist Gueltard, which was so similar to the fossil lilies of the rocks, that he called it a marine palm."

The French naturalist, Cuvier, was the first to discover the true nature of the crinoid. Careful study of the Trochites, the lilies of the rocks and the marine palm, revealed to him the relation existing between them and the fact that the crinoid was not a plant, but a marine *animal* of the sub-kingdom radiata, and class Echinodermata.

So striking is the resemblance between some species of the crinoid and some kinds of plants, that, while the correctness of Cuvier's deduction is not ques-

tioned, the idea has for a long time prevailed that the crinoid is really two-fold in its nature, animal and vegetable combined, thus constituting a connecting link between the two kingdoms. According to this idea, the crinoid was a marine animal-plant, whose house was in the bottom of the sea, where, with its roots anchored in the mud, or ooze, to some rock, stone or stick, it grew, budded and sent forth branches which developed into young crinoids. Such is the idea advanced by a writer in *Harper's Monthly* for February, 1879. "The true animal plants however," he remarks, "are without doubt crinoids or stone lilies. With them the resemblance is almost perfect, to the minutest particular. They resemble a flower borne upon a stem terminating in an organ called a calyx, which is, properly speaking, the body of the animal. Branches issue from the main stem, which at its base bears a sort of expanding root planted amid the rocks, and capable of growing by itself and nourishing the stem." The same idea has been more elaborately and poetically stated elsewhere.

According to this, the natural position of the crinoid is vertical, its roots buried in the mud and firmly anchored to some solid support. "In this way they lived and grew and flourished like beds of roses or other flowering shrubs. The extremities of the branching stalks budding, bloomed into young crinoids which after a time, having grown somewhat strong, cut loose from the parent stock, and floating off, roamed at pleasure through oceans depths until satisfied with this roving mode of life, and being more perfectly developed, it too settled down as its ancestors had done, and fastened its roots among the rocks, or in the mud, and there grew, and expanded its branches and put forth buds, and bore its crop, and sent out its progeny to assist in peopling the depths of old ocean. Those long stalks enabled the head to sway and move about within a certain distance, and with its long slender arms with their feathered pinulæ to seize the unwary minnow or star-fish or mollusk which happened to stray within its reach."

This is the poetry of science. Very beautiful, and attractive. Such was the crinoid the writer expected to find as he commenced excavations in these Crawfordsville beds eighteen years ago. But those dreams have never been realized. After years of delving and most careful search after what we fully believed to be a reality, we are reluctantly led to the conclusion that whatever may be found in other deposits, no such fossil exists in this. As we have read the description of the crinoid as written by nature herself in these rocks, it differs materially from the fancy sketch above.

We find no evidence of a dual nature in the crinoid—animal and plant combined—a connecting link between the animal and vegetable kingdoms. This idea has no doubt originated in the striking external resemblance of some species of crinoids to certain plants, and especially to the lily. But this resemblance, even in the most striking cases, is only external, while the *internal* structure in every instance is entirely different.

Furthermore this resemblance, instead of being general as many suppose, is really of rare occurrence. Most species of crinoids in their external appearance

would never suggest the idea of a plant, and least of all a lily. The young scientist named his first specimen "a petrified toad," and the resemblance is very striking. He might have named another "a petrified chicken's claw" and he would have had the scientific name in English, and a likeness even more striking than in the first case. Who would ever think of calling the warty *goniasteroidocrinus* with its long flexible stem coiled and knotted like a snake or some great worm, and tapering to a perfect point—who would think of calling this thing a connecting link between the animal and vegetable kingdoms? And how such things as these are to anchor themselves to some stick or stone and maintain an upright position is more than we can imagine. Very many species of crinoids have nothing to resemble a root at the extremity of the stem. And where this resemblance does exist, there is not the least evidence that they served any of the purposes of a regular root.

Of those spreading branches, budding and putting forth young crinoids "to people old ocean," we find not the last evidence. The theory is doubtless a deduction from analogy. The testimony of the rocks upon this point is very meager, but from the best evidence we can find we incline to the belief that these Paleozoic crinoids were oviparous.

Since the days of Cuvier, much time and attention have been given to the study of these animals, especially their structure and classification. In form they present almost an endless variety. Upon this point we quote the beautiful language of Professor Louis Agassiz: "After thirty years' study of these fossil crinoids, I am every day astonished by some new evidence of the ingenuity, the invention, the skill, if I may so speak, shown in varying this single pattern of animal life. * * * They seem like the productions of one who handles his work with an infinite ease and delight, taking pleasure in presenting the same thought under a thousand different aspects. Some new cut of the plates, some slight change in their relative positions is continually varying their outline, from a close cup to an open crown, from the long pear-shaped oval of the calyx in some, to its circular, or square, or pentagonal form in others. An angle that is simple in one projects by a fold of the surface and becomes a fluted column in another; a plate that was smooth but now has here a symmetrical figure upon it drawn in beaded lines; * * * . It would require an endless number of illustrations to give even a faint idea of the variety of these fossil crinoids."

The limits of this article will admit only of a general description of the structure of these animals. The head, which in some species resembles a flower, is really the body of the animal, and consists of a cavity or calyx composed of a number of calcareous plates, joined together in the living subject by membranous attachments. Within this cavity were enclosed all the vital organs. In some instances the vault of this cavity is prolonged into a slender tube varying in length in different species. The cavity of most crinoids is fringed with arms, some simple, others branching, the number varying with the species. These arms are also composed of calcareous plates arranged in single, double or quad-

ruple rows. Some of these much resemble the scales of a chicken's foot, others the braids of a whip lash, others still the rows of kernels upon an ear of corn. These arms contain ambulacral processes which connect with the organs of nutrition within the cavity or calyx. The inner edges of these arms are fringed with pinulæ or filaments resembling the margins of a feather or quill, or with tentacles. Through these delicate organs it is now supposed that the animal absorbed a glutinous substance found at the bottom of the sea, which, passing through the hollow spaces within the arms into the organs of nutrition within the calyx, nourished the animal. This of course is at variance with the idea advanced in both extracts above, and illustrated by a cut in Murchison's Silurian and in some early geologies, which represents a crinoid with its long, slender proboscis thrust into the shell of a mollusk upon which it was supposed to be feeding. But without doubt, this picture, thus explained, reverses the order of nature. The mollusk was feeding upon the crinoid. Various facts confirm us in this opinion.

In the first place it is now quite well established that the proboscis, once regarded as a passage for food, is really an anal tube, and that there is in the Paleozoic crinoids no oral opening through the wall of the calyx except the passages connected with the ambulacral processes of the arms. Furthermore, we have in our possession a number of specimens with mollusks, especially *Platyceras infundibulum* (M. & W.) firmly attached to the crinoids, and in every case the aperture of the mollusk covers the anal opening. In all these cases therefore, the crinoid could not have been feeding upon the mollusk, unless this opening is both anal and oral, as some suppose. If this be the case, and the crinoid is really devouring the mollusk, then we should expect to find the crinoid in a healthy condition in every case, and the mollusk the reverse. Now the fact is that of a large number of specimens of this kind, in every instance the mollusk is in a perfect and healthy condition, while the crinoids, in nearly every instance, are more or less imperfect and decayed. The apparent exceptions are cases in which it is evident that the mollusk became attached to the crinoid only a short time before both perished. It is exceedingly interesting to note the different stages of decay in the crinoid as illustrated in the specimens alluded to. First there is a slight depression of the calyx opposite the anal; then it is cupped more and more. Finally the calyx is completely collapsed, and so the process continues until nothing is left but the plates and rings, which lie scattered about the aperture of the mollusk, which has continued to become more stout and robust throughout the entire process. I have repeatedly found a *Platyceras equilatera* attached to the anal tube of *Actinocrinus indianencis*, and *A. ramulosus, and inclosed within the arms*. At first I congratulated myself upon the discovery of a case in which the crinoid was actually feeding upon the mollusk. Examining the specimen more carefully, I discovered that the proboscis was entirely gone, and the plates were lying about the aperture of the mollusk, and that the aperture was fastened upon the vault and directly over the opening into the cavity. A great number of such specimens as these have convinced the writer that vast

numbers of these animals were destroyed in this way, and that the crinoids did not subsist upon "minnows, or star-fishes, or mollusks that happened to come in their way." Indeed, we must confess that after years of very careful observation we have never yet found a specimen which furnished *satisfactory* evidence as to what the crinoid subsisted upon.

To the head of the crinoid was attached an appendage, which, for want of a better name, we call a stem. This is composed of a series of flat calcareous rings or plates, perforated at the center. The reader will recognize in these plates the Pulley-stones, and St. Cuthbert's Beads already alluded to. The broad surfaces of these rings, in the larger species especially, are striated from the central perforation to the circumference. As the surface of the plates enlarges towards the circumference the striæ bifurcate to keep the intervening spaces all equal. These plates are laid one upon another, the surfaces being so arranged that the striations of the one fit exactly into the little grooves of the other, the sutures around the margins having the appearance of saw-teeth fitted together. By this means the possibility of any rotary movement of the plates upon each other seems to have been effectually prevented. This, however, did not prevent considerable flexibility in the stem, as in the case of the *Goniasteroidocrinus* already alluded to.

So great is the diversity in the exteral margins of these rings, that it is easy to distinguish many species by the appearance of the stems. We feel satisfied that, before a complete and satisfactory classification of these animals can be made, these stems will need to be more thoroughly studied. Endless variety would seem to be the design of nature in the construction of these stems as in the other parts of these animals. And equally interesting is the study of the different construction and markings of this singular appendage.

The growth of the stem seems to have been by successive additions of new plates at the junction with the base of the head. In most species these at first are quite thin, but they increase in thickness as the formation of new plates removed the older ones farther and farther from the point of origin. By this double process, no doubt, the stems were lengthened. These plates were doubtless held together by muscular attachments, and the cavity within filled with animal substance.

Everything seems to indicate that these stems, and the arms as well, were exceedingly fragile, and on this account, it is very difficult to obtain an entire crinoid, or even a head with a long piece of stem attached. No doubt many suppose this is owing to the difficulty of removing the specimens from the quarry without breaking, but such is not the case. The fact is, the crinoids were broken before they were fossilized, even while yet alive. In the large slab already alluded to, containing eighty crinoids, not more than half a dozen were entire, and these were mostly young specimens, or small species. The stems were nearly all broken, having been slipped apart at the joints, leaving stumps of various lengths attached to heads. In removing the matrix from specimens in these large slabs, I have repeatedly found the stems disjointed by too short a

fold in the sinuosities, or by some short turn in the direction of the animal's course in forcing its way through the mud, the parts being left in such relation to each other, as to indicate, not only their connection, but also the method by which the separation had been made. In this way the stem is not only broken once, but in some cases, several times. These facts, with others, incline the writer to the belief that the natural position of the crinoid was horizontal rather than vertical, living in the mud at the bottom of the sea.

The long slender arms, with their fringes of pinnulæ or tentacles, were also easily disjointed, especially at the point of connection with the calyx. Very few specimens retain them all entire. Frequently the arms are all gone, leaving nothing but the calyx. We have frequently found these long slender arms turned back upon the stem and disjointed, three or four of them sometimes, lying near together, some near the head, others a few inches back along the stem, as though the animal had left them behind in forcing its way through the mud. In removing the matrix from specimens, and especially in the large slabs, these detached arms are frequently met with. It will be seen from these facts, that the value of cabinet specimens must increase very rapidly in proportion to the perfection of the head, and the length of the stem.

It is an interesting fact that these Crawfordsville beds very clearly indicate a deterioration in the crinoids in ascending from the lower to the higher strata. In the outcrop near the level of the creek, are found remains of crinoids perfectly enormous compared with the same species higher up in the bluff. If the heads connected with these fragments of stems, bore the same relation to them that the heads above do to their stems, they must have been giants from eighteen inches to two feet in length. But no heads belonging to these stems have ever been found. As far as excavations have been made, the largest species and the largest specimens of species which extend to the top of the shale, are found in the lowest strata. Long ages must have elapsed during the formation of these rocks, and the period of life recorded in them.

Near the commencement of the Carboniferous period here represented, the crinoid seems to have reached the zenith of its glory in size and in numbers, and then began to wane, leaving in the same deposit the record of its glory and of its decline.

THE GEOLOGICAL SURVEY OF KANSAS.

A geological survey, carefully made, of any extended area, reveals the character of the rock formations for several hundred feet of thickness, and therefore makes known where *may* or *may not* be found the useful minerals—coal, salt, building-stone, iron, lead, etc.

Such a survey also makes known the *dip* or slope of the strata, and therefore gives indications of probable water supply in various localities.

Much geological knowledge of Kansas has been obtained, but it is in the

hands of private persons who have in their devotion to science made many explorations, but this knowledge is available by the public generally to a very limited extent. Within the last two years, geologists have found minerals in our western counties which further examination will doubtless show to be of considerable value, and which are even now being utilized.

Nearly all civilized countries have caused surveys to be made which, conducted simply as for the definite advancement of science, have yet revealed material resources which have largely added to the outlets for the useful employment of capital and labor.

Many of our sister States have caused geological surveys to be made, extending over a long series of years, which have made known mineral resources the use of which has greatly increased the wealth of the State.

In Michigan, there are now millions of dollars of taxable value in salt works, the existence of which is due entirely to the geological survey.

One county in Ohio (Tuscarawas) has a large industry in mining coal, the existence of which was made known by the geological survey. The State of Ohio as a whole has been immensely benefited by the survey, on which it has expended large sums.

The great State of New York has employed eminent geologists for a long time with experts in other departments of science, at a total cost of over half a million dollars, and the evidence of the most direct kind shows that the expenditure has resulted in the profitable investment of capital to a great amount; and unprofitable investments in prospecting for minerals, which were formerly common in that State, have ceased since the definite results of the survey have been made known.

In every State that has tried it, benefits have been received from this work in proportion to the time and expense that have been spent on it.

In our own State, the lack of definite knowledge as to the boundaries of our coal fields has led to the expenditure of capital in many useless undertakings. For example, in Morris County a shaft to the depth of three hundred feet was sunk; in Sedgwick County a depth of eleven hundred feet was reached, and in Marion a boring of seven hundred feet was made—all at great cost and without any returns.

Ignorance of the principles and facts that govern the supply of water in wells is in many places leading to similar wasteful experiments. A geological survey would stop this waste, and point out directions where labor would meet with reward and capital increase by investment.

The cost of a survey is so small, compared with the advantages to be reaped, that there should be no longer delay. A tax of one-twentieth of a mill would produce about as much revenue as it would require to put the survey in good working condition, though a larger sum would hasten the final accomplishment. This continued for a series of years would produce results in scientific and economic progress, of which all citizens would be justly proud.

THE LAST SUBMERSION AND EMERGENCE OF SOUTH-EASTERN KANSAS FROM THE CARBONIFEROUS SEAS, OR THOSE EFFECTING THE CARBONIFEROUS FORMATION IN KANSAS.

E. P. WEST, UNIVERSITY OF KANSAS.

[*Continued.*]

Since my paper, bearing upon this subject, was read before the Kansas Academy of Science, at its recent session in Lawrence, I have had an opportunity to extend the boundary of my observations to a limited extent; embracing a very small field of strata newer than the Permian formation.

These extended investigations tend to confirm the opinion I expressed in the paper referred to, that the wide-spread erosion in South-eastern Kansas may have occurred at a comparatively recent time. These newer strata were involved in it as well as the coal measures and Permian formation, and I have no doubt the cretaceous (if the newer strata referred to do not belong to it), tertiary, and early post-tertiary strata also. These and other facts which have been ascertained, pertinent to the subject, would indicate the later Post-Tertiary or Champlain epoch as the era of these occurrences.

Near Wellington, Kansas, and in a large area of country around it, extending westward to Harper and Attica, along the Southern Kansas Railway, ancient, modified drift is encountered. At Wellington, and many other places in the country adjacent, these beds are worked for the sand they contain. Fragments of the local rocks, which have been torn down from their beds, are profusely intermingled in them. The process of obtaining the sand, when mined, is by running it through a sieve to separate the drift gravel and fragments of local rocks from it. The pits show the gravel beds to be stratified, and evidently deposited by water, and being too extended for river work, they must be assigned to the same agency which wrought the distinction in other portions of southeastern Kansas, *i. e.*, to water aggregated in shallow seas. Mixed in with the sand, gravel, and fragments of local rocks, the bones of extinct post-tertiary animals are frequently found, namely, the mastodon, elephant, bison, and others whose species have not been determined.

In the Loess deposits, bordering the Missouri River, though not so frequently encountered, the bones of the same animals are found, together with the shells of Helix, Planorbis, Succinea, and other land and fresh-water shells identical with living species in the same locality. These remains are buried all through the Loess, from near the surface to a depth of from one hundred to two hundred feet.

The bones of a very large elephant were found in the alluvial deposits at

Ottawa, Kansas, and other similar bones in an equivalent deposit near Papinsville, Missouri. At this latter place the tooth of an extinct species of the horse was found in a bed of water-worn pebbles, under alluvial deposits, thirty-two feet below the surface.

Since my paper was read one of the students, Mr. Joseph Thoburn, has presented to the University some water-worn pebbles from Marion County, Kansas, which contain fossil shells identical with the shells of the undisturbed local rocks of that county and, a few days since, there was received, at the University, a fine specimen of petrified wood, from Russell County, sent by the Rev. J. D. Parker, U. S. A. This specimen is similar to the silicified wood referred to in my paper, and which is so generally distributed over southeastern Kansas. But whether this specimen was found upon the surface or in the alluvial deposits of that county is not stated.

Near Scipio, six miles north of Garnett, there is a small patch of rocks standing vertically to the plane of stratification, having evidently been tumbled down from a higher level. I am told they are sandstone, but I have only seen them from the car windows while passing on the railway. The other rocks, in the vicinity, are all limestone, and their stratification is undisturbed. Between Scipio and Garnett, and south and west of the latter place, sparsely scattered over the surface of the country there are found small masses of flint, from one to six or eight inches in diameter, very similar to that seen in the Flint Hills, and it is probable that a spur or local bed of the Permian strata, of no great thickness, was destroyed in this scope of country.

These facts in connection with those in my former paper would indicate pretty conclusively, that the denudation of southeastern Kansas and the deposition of the Loess along the Missouri River occurred at the same time; that the submergence involved nearly all, if not all, of Kansas as well as parts of Iowa, Nebraska, Missouri, Illinois, Arkansas, Louisiana, Indian Territory, and Texas, and, that a part of the Permian formation outlying in spurs or local beds may have been destroyed.

The submersion of the land was most probably as gradual as its emergence undoubtedly was, for the Loess deposits along the Missouri River could only have been made in still waters which were very gradually receding; and every successive inch of the river, from Omaha, Nebraska, to the present outlet of the Mississippi River at the Gulf of Mexico, at one time during the subsidence of the waters must have been the mouth of the stream.

The encroachment of the water began at the shore line of the Gulf of Mexico, wherever that may have been in the later Post-Tertiary time, and extended, more or less gradually, until the country within the limits before named, at least, was under water. During this time, the rivers emptying into the seas would deposit sediment at their mouths, and the mouth of the stream would recede, upward, as the waters of the seas advanced. But it was during the retiring of the water that the Loess deposit was given its final and distinctive character as such. The recession of the water was from up the streams downward, and the

mouth of the rivers would advance and leave their deposits of sediment, as the water of the seas retired.

But none of the rivers which emptied into those seas have a well-defined Loess deposit except the Missouri. The Kansas, the Arkansas, and their tributaries seem to have had their debouch into interior lakes during the recession of the water and their sedimentary deposits, which were very limited in amount, were made in them. The Missouri was the only river, perhaps, which had an uninterrupted gradual fall during the elevation of these lands for the last time.

Most of the Post-Tertiary animals, which before had drawn abundant sustenance from the country, were destroyed by unfavorable conditions and became extinct during this last invasion of their province.

Another important question remains to be answered, *i. e.*, whether man witnessed these occurrences? We have reason to believe that he did, and survived the unfavorable surroundings which destroyed most of his humbler co-habitants. His remains have been found, both in Europe and in this country, associated with older formations. His bones and implements have been found in the alluvial deposits of this era under conditions which leave but little doubt that they were buried in, by natural agencies, during their pendency. His monuments stand out, conspicuously, in unbroken lines, for hundreds of miles from the summits of the graceful Loess hills which had their birth in this epoch. He has sculptured the greatest of the extinct mammals, and could only have drawn the conception from the living animal. The conditions were not very dissimilar from those of to day; and we may feel assured that he played a leading part at this stage of the world's progress, as he has since done in a more conspicuous manner.

Before closing this paper it is but just that I acknowledge, on behalf of the University of Kansas, the courtesy of the officers of the Southern Kansas Railway extended to it, and thank them for the interest they have always manifested in the advancement of science and the development of the material resources of Kansas, especially those great interests along the line of their road. Personally, I must acknowledge the invariable kindness I everywhere received from all the officers and employees of the road during my work along its line; and the pick and shovel, associated with these courtesies, will ever be among my pleasant remembrances.

KANSAS SCIENTIFIC SURVEY.

PROF. JOHN D. PARKER, U. S. A.

The Kansas Academy of Science, at the late annual meeting at Lawrence, took steps to inaugurate a thorough scientific survey of the State of Kansas. In the early history of the State two preliminary reports were made by Professors Mudge and Swallow, and the members of the Academy have made valuable

contributions to our knowledge of the science of the State in several departments. Prof. O. St. John, the accomplished paleontologist, has run a stratigraphical line along the Kansas river from Wyandotte to Manhattan, has carefully determined the formations, and has drawn a chart representing the strata along this base line. He has also, during the past year, located some valuable coal fields in Southern Kansas beyond what was supposed to be the boundary of the coal formations. Prof. Frank H. Snow of the State University has made important contributions to our knowledge of the birds and insects of the State, and of the fish in the Kansas River. Prof. E. A. Popenoe of the Agricultural College, has made valuable additions to our knowledge of the insects. Professors Carruth and Snow, with the assistance of others, have worked faithfully on the catalogue of the plants of the State. Profs. Snow and Lovewell, Major Hawn and others have taken meteorological observations for years, and have done much to determine the climate of Kansas. Mr. Robert Hay has performed some excellent geological work in Norton county, under the auspices of the Academy, and has published a geological map of the county. Professor F. W. Cragin of Washburn College has published partial lists of Kansas mosses, lichens, algæ and fungi, and has made a good beginning in collecting and identifying the lower plants of the State. The chemists have also been at work, and Professors Failyer, Patrick, Bailey, and others have made some valuable analyses. All of this labor of the Academy, covering about two decades of years, has been accomplished by volunteer workers, without costing the State of Kansas a single dollar.

The time has now fully arrived for the Kansas Legislature to take up the scientific survey of the State, to utilize the results already attained, and to carry on the work so well begun to its completion. Kansas is unusually rich in mineral resources which need to be developed by a thorough and complete geological survey. Very little is known at present of the immense coal fields of the State. The lead interests are still in their infancy. Probably there are zinc deposits undetermined. The State has unlimited beds of limestone and freestone, constituting the finest building material in the West, much of which is undeveloped. The Burlington Gravel Beds furnish some of the best gravel for our street pavements, and would, if thoroughly explored, furnish an abundance of the best ballasting for railroads. A physical survey would determine the water power of the State, enabling capitalists to plant factories wherever they can be established. Little is known of the saline deposits of the State. The vast gypsum beds of Kansas need development. A thorough and complete survey would develop these immense resources, form a basis for material industries of every description and add largely to the wealth of the State.

Geological surveys have been prosecuted in the leading States of the Union with the most valuable results. In Michigan there are now millions of dollars of taxable property in salt works, the existence of which is due entirely to the geological survey. The survey developed two rich salt deposits, and the annual export of salt has now reached about a million dollars. The Ohio geological survey developed a fine industry in mining coal in Tuscarawas county. New

York has spent over half a million dollars on her scientific survey, and her rocks have become classic ground. The New York scientific nomenclature is known in all countries, and is the nomenclature of our best geological text books. Her survey has resulted in the profitable investment of a large amount of capital, and since the definite results of the survey have been made known, the unprofitable investment in prospecting for minerals, formerly so common, has ceased. Several other States have prosecuted geological surveys which have fostered many industries and added much to their material wealth.

But the scientific survey of any country has, we believe, a higher and a broader plane than even the development of its mineral resources. A free and an intelligent people, like those of Kansas, stand related to nature, at many points where science touches the inner life. Nature in her material aspects, contributes to our physical wants, and supplies from her abundant resources the materials with which our homes are constructed, furnished, and beautified. But in a deeper sense nature speaks a language which fills the thoughtful mind with higher and better truths. When nature unfolds her deeper meaning to the percipient mind science begins to fertilize every department of life. The people of Kansas need ample collections in all departments of nature to illustrate scientific studies. The State has already suffered irreparable loss in the transportation from her Western borders of the finest and rarest specimens, to enrich the cabinets of Eastern colleges and universities. Prof. Marsh of Yale College has paid $1,000 a year to cover the transportation of vertebrate fossils, collected in Western Kansas. Such materials are the richest endowments of educational institutions, and are indispensable in educational processes when conducted on the best plan. Kansas can ill afford to let Eastern institutions rob her colleges, on account of her lethargy, of rare material of learning which, once gone, can never be replaced.

During our civil strife, Kansas won golden opinions over the civilized world for the advanced position she took and held in the maintenance of the ideas of freedom. She has a double land grant for the establishment and maintenance of public schools, and her State University has already exhibited a wonderfully vigorous growth. Her Agricultural College, in spite of many discouragements in past years, is beginning to yield excellent results. Intelligent people all over the State are very anxious to have the scientific survey begin at the earliest practical moment, for Kansas cannot afford to lag behind her sister States in this fundamental work which lies at the base of the highest physical development and the best intellectual culture.

The Legislature of Kansas can not do any act which will contribute more to the welfare of all the people of the State and be more acceptable to all intelligent citizens, than to inaugurate the geological survey of the State during the coming session.—*Kansas City Journal.*

THE AGE OF THE WORLD.

REV. L. J. TEMPLIN.

Scarce a generation has passed away since it was the almost universal belief among the common people that the earth, in both its material and form, was only about 6,000 years old. When geology began to teach that the age of the world was to be reckoned by not only thousands and tens of thousands, but by millions of years, it was arraigned as being in opposition to the word of God, being infidel if not atheistic in its tendencies. But now, few if any persons, who have any just claims to be considered intelligent, question the great antiquity of the earth. But only those who have given special attention to the subject are aware of the vast amount of evidence in favor of this view that is presented by the present condition of the rocks composing the solid crust of the earth.

To give even an abstract of all the proofs that exist in favor of this doctrine would require a large volume; much less can it be compressed within the narrow limits of a magazine article. A cursory view of a few representative facts and general principles, is all that can be attempted in the present discussion.

There was doubtless a period in the earth's history when its whole mass was in a state of igneous fusion. When it had become sufficiently cooled to permit the existence of water on its surface, currents would be formed, and erosion would begin. The eroded material would be deposited in still water and form sedimentary rocks. These would be laid down in horizontal, or nearly horizontal, strata. The cooling of the earth would cause contraction, and this would produce subsidence in places and upheavals in others. By these means the strata, already laid down, would be broken, contorted, and tilted at various angles, leaving the edges exposed. As erosion would go on, new strata would be deposited on the upturned edges of the older strata, but unconformable with them. These coördinate processes would go on as long as the vertical oscillations in the crust of the earth should occur. And they have been in operation from those early times, when all the water on the earth was probably kept at a boiling temperature, till the present, and we find them still in operation, and still producing the same results. In studying the sedimentary rocks, it should be always kept before the mind, that they have been formed by the double process spoken of above; and that these have exactly balanced each other; the denudation being exactly commensurate with the deposition. The amount of this sedimentary matter, in the aggregate, is enormous.

The various formations vary greatly, being thicker in places, thinner in others, and entirely wanting in still others; but taken altogether, they constitute a thickness of about 72,000 feet, or thirteen and a half miles. In considering these rocks in relation to time, the mind should divest itself of all idea of reducing it to any statement in years. But there are numerous facts connected with

their formation that indicate an enormous lapse of time. The enormous depth and vast extent of some of these formations, with certain attendant facts and conditions, impress the mind almost with the force of a demonstration, that the lapse of time during their formation must have been inconceivably great. Let us begin with the Laurentian, the oldest fossil-bearing rock known to exist. These are found to exist over a wide extent of country in both America and Europe. They attain their greatest known development in Canada, where they exist to the thickness of 40,000 feet. Supposing that they were formed by the gradual detrition of older rocks, and the deposition of the debris at the bottom of the ocean, the time required for the accumulation of such vast quantities of rock material must have been very great. This fact seems further evident from the presence in these rocks of certain substances that were accumulated in them during their formation. Interstratified with the rocks, and sometimes existing in pure beds, is found large quantities of graphite. This is doubtless the result of the perfect carbonization of vegetable matter.

The growth of this vegetation would require long lapse of time, after which it would probably pass slowly through the various grades of lignite, brown coal, and anthracite, before reaching the stage of graphite. Another fact that seems to demand the same interpretation in its relation to time, is the vast deposits of iron ore during the Laurentian period. It is in the rocks of this period that we find the rich iron beds of Missouri, New Jersey, Lake Superior, and Sweden. This ore is supposed to have accumulated by the leaching of the oxides and carbonates of iron from the rocks, and its precipitation under the influence of decaying vegetation.

Now if all the vast beds named above have been deposited by this process, it must have consumed almost inconceivable time. The great Iron Mountain, of Missouri, itself is estimated to contain not less than 600,000,000 tons of iron above the level of the surrounding country. Extensive beds of limestone are also found here; and as these are supposed to be composed of the shells of molluscs and protozoans; the time for them to live and die in quantities sufficient to form such extensive beds of their calcareous remains, could scarcely be reckoned in years. Next above these Eozoic rocks are the Silurian, aggregating a thickness of over 25,000 feet, and crowded with fossils, both animal and vegetable. More than 10,000 different species of fossil animals are already known to belong to this system. These are not, as we would naturally expect from the age of the rocks, of simple and primitive forms; but they are of widely differentiated and highly specialized forms. Coming in as they do, suddenly, in such great variety, and on such a high plane of organic life, how to account for their origin on the hypothesis of evolution has been a very difficult problem. In order to surmount the difficulty, believers in this doctrine generally take refuge in the assumption that between the close of the Eozoic age, and the beginning of the Silurian age, as represented in the rock of the two systems, there must have been an enormous lapse of time, exceeding in extent all the time required for the formation of the rocks composing both these systems.

It was during this long interval that all these organic forms were evolved by natural selection. When asked why such must have been the case it is answered that we must admit this explanation or we have no explanation; and because it cannot be disproved, therefore it must be true. And this is called science. There is abundant proof of the enormous lapse of time without resorting to this manner of assuming that our ignorance is knowledge. Such a lapse of time may have passed in this interval, but that such was the case is without proof except as the evolution hypothesis is assumed as proof; but this itself is sadly in need of proof. We pass over the next—Devonian—age with the single remark that the rocks of this system, containing the fossil forms of numerous species of organic forms, especially fishes, give proof that long ages must have elapsed during their deposition.

We next come to the carboniferous age—age of acrogens or coal age. Here we find the most indisputable evidence of enormous stretches of time. The foot-prints of time are so indelibly impressed on the rocks of this age, that in some places some approximation to a calculation may be made. The thickness of the rocks of this system vary from 9,000 feet to 15,000 feet. The coal-measures proper vary between 4,500 and 13,000 feet. We here have the most irrefragible proofs of the frequent oscillation of the earth's crust. The seams of coal, which compose but a small portion of the thickness of these rocks, are interstratified with the various strata of sandstones, shale, and limestone composing this formation.

As coal is the product of vegetation, which must have grown at the surface, it is evident that to form the seams of coal found at various depths would require that each of these various horizons should have been at the surface at the time when the material forming the coal was accumulated. Now, we find in different coal-fields considerable numbers of these seams separated by intervening strata of rock. Thus in Nova Scotia there are 81; in Wales 100; in Belgium 100; in Westphalia 117. These aggregate, in some cases, as much as 150 feet of coal that would be passed through in sinking a shaft from the surface to the lowest coal-seam. It is evident that where these different seams are found, the land has been elevated and depressed at least once for each of the seams found.

There would be a long period when the land surface was above the water; immense forests of vegetation would flourish until a huge layer of it was accumulated, when by some convulsion of the crust of the earth, or by a gentle—perhaps to human eyes it would have been imperceptible—subsidence, it would be depressed below the waves and receive, either from fluviatile or marine sediment, a layer of earthy material, covering the layer of organic matter to a depth of many feet. A reversal of the process by which the land was depressed, again elevates the surface above the waters, and again a layer of vegetation would be produced, to be in turn buried as the former was. And thus these alternate elevations and depressions continued till, as we have seen in some cases, an hundred or more beds of vegetable matter have successively grown

and been buried. The pressure and heat to which this organic matter was subjected after such burial, eliminated the greater portion of the volatile gases and converted it into coal. The time necessary for the accumulation of all the organic matter contained in all these strata, and in the subsidence and elevation, and for the deposition of the sedimentary materials composing the rocky strata interposed between these coal-seams, can not be estimated—even approximately. But we are sure it must have far exceeded all conceptions of duration that we can form from our knowledge of human history. We have no data on which to base any estimate of the rate of the accumulation of sedimentary matter, except the present rate of sedimentary deposition at the mouths of rivers. The present average amount of sediment carried down by the Mississippi amounts to enough to cover one mile square to a depth of 268 feet annually; or about one cubic mile in twenty years. At this rate it is estimated that it would have required about 1,000,000 years to have carried down and deposited the amount of materials that originally composed the rocks of the coal-measures in the coal-fields noticed above.

The time occupied in the growth of the vegetation that formed the various beds of coal may be more nearly approximated. If we assume the amount of vegetation growing on one acre at 2,000 pounds, this would give in 100 years 100 tons. This compressed into coal and spread over an acre of ground would give a thickness of one-eighth of an inch of coal in a century; or 10,000 years would be consumed in producing one foot of coal. This would require, to produce 150 feet, as found in some regions, no less than 1,500,000 years. But probably the growth of coal-plants, with the very high temperature and heavy atmosphere, laden as it was with carbonic acid that prevailed during the coal age, would produce a much larger growth of vegetation than we have estimated, and the time would be accordingly diminished. But making due allowance for this, there is no question but the time required for the growth of all this vegetable matter, the frequent subsidences and elevations, and the accumulation of the sedimentary matter composing the rocks of this formation must have required many hundreds of thousands if not millions of years.

Another remarkable illustration of alternate elevation and depression, or at least of alternate land and water surface is found in the Amethyst Mountain, in Yellowstone Park. This mountain is made up of alternate layers of sand-stone and conglomerates, and the remains of gigantic forest trees. The stumps and trunks of these trees are found imbedded in the rock material of the mountain at various altitudes; the stumps five to six feet in diameter, and the trunks sixty feet long. It would seem that a forest of these gigantic trees would flourish for a time—perhaps for centuries—and then be overwhelmed with a flood, bringing down sand, gravel, and broken stones, completely covering the site of the forest. This would become the soil upon which another forest would spring up and grow, only to be buried up as its predecessor was. And this process of alternate growth and burial has gone on till from one to two score of these gigantic forests have flourished and passed away. Since the last one passed

away the mountain has been elevated 3,000 feet above the river. The time required for all these changes must far exceed all our conceptions of duration.

It is an undoubted fact that the topography of the present surface of the earth has been largely affected by erosion. This process is constantly going on, degrading the eminences, changing the declivities, and gradually wearing away the whole surface of the land. The sum of this erosion, since the last great geological changes, is enormous. The amount of erosion over many portions of England is estimated at 10,000 to 11,000 feet.

In the Appalachian region it is proved that the erosion has amounted in some cases to not less than 20,000 feet in depth. In portions of the Rocky Mountain regions this erosion has been still greater. Professor Powell informs us that in the Uintah region the amount of erosion has exceeded five miles in depth in some places, with an average depth of three and a half miles over 2,000 square miles of country. The time necessary for the removal of so large an amount of material of course would depend on the agencies employed and the energy with which they operated. It would undoubtedly be vast.

Water, aided by frost, is probably the principal agent operating in producing all the erosion that has taken place on the earth. The power of water to "wear away a stone" is witnessed in the wonderful channels they have cut for themselves during the present geological age. The Niagara River has cut a channel about 200 feet deep a distance of seven miles. Mr. Lyell estimates 36,000 years as the time necessary for the accomplishment of the task; but as we know neither the present nor the past rate of progress the river has made, such estimates are perfectly unreliable.

A very noted example of river erosion is exhibited by the Grand Cañon of the Colorado River, which is 300 miles long and from 2,000 to 6,000 feet deep. But we have no data from which to estimate the time required for the river to cut its way through this distance of rock. We do not know the present rate of recession, nor do we know but the river simply followed and enlarged a crevasse that had been formed by some convulsion of nature. As all such data are unreliable, all conclusions drawn from them must be fallacious.

The general erosion of the whole surface of the earth may be estimated by measuring the amount of sediment that is now carried down by the rivers of the globe. As we have previously stated, the amount of materials composing the sedimentary rocks is the amount that has been eroded. This, it is estimated, would be equivalent to 2,000 feet in depth over the whole surface of the earth; and if taken from the present land surface, it would equal an average of not less than 6,000 feet over the whole land surface. The average erosion of the general surface of the earth as estimated from river sediment cannot be less than one foot in 5,000 years. At this rate it would require, to remove an average thickness of 6,000 feet no less than 30,000,000 of years. And this is the estimate some would place on the age of the earth, since the first sedimentary rocks were laid down.

But two facts present themselves for consideration here, that go far to vitiate

all such estimates. One is, the fact that in the earlier ages of the world, the higher temperature that prevailed, and the large per cent of alkaline and acid substances held in solution by the water, would greatly increase its erosive power, thus requiring a far shorter time to produce a definite amount of sediment than is required at the present time. This would require a large reduction of the above estimate. But on the other hand we have the fact that the erosion that is now taking place is principally operating on sedimentary rocks; and doubtless this has been true during a great portion of geologic time. The same material has been laid down and removed again and again, so that an estimate of the time that it would take to deposit the materials of the sedimentary rocks as we know them, gives but a very slight clew to the time since the beginning of their deposition.

We conclude, therefore, that all efforts to deduce from the above data any definite estimate of the age of the earth in years, are futile; and all conclusions drawn from such calculations are fallacious and misleading. In the beginning of this article we spoke of the probable fluid condition of the earth: but if this theory is correct, it is evident that that is not the beginning of the earth's history. The same reasoning that would demand such a condition, would lead us on to a period when this same matter was in a gaseous state; when as incandescent gaseous matter, it was expanded in space. But supposing this to have been the true history of this world, it is evident that no data exist on which to found any estimate of time as applied to this stage of its existence. It is only when it has reached a liquid condition that any basis is furnished for a calculation of time as applied to its history.

Different scholars have attempted a calculation of the age of the earth from the rate of cooling of heated bodies exposed to a cold atmosphere. But the various elements entering into the mathematical analysis of this problem, are so numerous and uncertain, that there is no agreement in the conclusions arrived at. These conclusions vary from 160,000,000 to 600,000,000 of years as the probable time required to bring the earth from a fluid state to its present condition.

From all the foregoing considerations we are led to the conviction that though the earth has existed for an inconceivable length of time, yet from the data at command it is impossible to reduce it, even approximately, to years; that these unmeasured and unmeasurable years are known only to Him who is from everlasting to everlasting, yesterday, to-day, and forever.

Cañon City, Col., January, 1885.

BIOLOGY.

ON THE WASHBURN BIOLOGICAL SURVEY OF KANSAS.

F. W. CRAGIN, SC. B.

It is proposed to conduct, under the auspices of Washburn College, an informal biological survey of Kansas. The work has already been in progress for some months, and will probably require five, and perhaps ten, years for the accomplishment of its objects.

While the more popular portions of our fauna and flora, and particularly our birds, insects, and flowering-plants, have been studied by Profs. Snow, Popenoe and Carruth, Col. Goss, and others, no attempt has hitherto been made at a systematic survey of the entire field of Kansas botany and zoölogy. The work now proposed, while placing our State in a position where, as regards our knowledge of its natural history (geology excepted), it will compare well with its older sisters in the East, will present to science the facies of a typical prairie fauna and flora, will serve to define more clearly the relations of the Eastern, Central, Sonoran and Austroriparian faunal regions, and cannot fail to throw other important light upon the subject of bio-geography and variation.

We have said "geology excepted" because, while there are few States of whose geology, whether considered in its scientific or in its economic aspect, so little is known as of that of Kansas, it is neither part nor possibility of the present undertaking to include a State geological survey. Such a survey is imperatively needed, but is of too great magnitude for private enterprise, and its execution must be left to the State.

The object of the proposed survey is simply to investigate the fauna and flora of a State which, together with Indian Territory, holds the key to a more definite knowledge of the inter-relationship of four great faunal regions. It is believed that this object will commend itself to all intelligent and public-spirited citizens of the State; and the coöperation of such is invited in the collection and donation of specimens of mammals, reptiles, fishes, shells, insects, crustaceans, flowering plants, ferns, mosses, lichens, *Fungi*, *Algæ*, or, in short, of whatever lines of material can locally be collected to best advantage.

The progress of the survey will be recorded in the form of partial reports, or contributions and notes, which will come from specialists to whom the material brought together by the survey will be submitted.

Some of the departments are still unprovided for; but the names of the following eminent specialists, whose services have been secured, are a sufficient guarantee for the value of the proposed work: For the fishes, Prof. Chas. H.

Gilbert, of Bloomington, Ind.; land-shells, Mr. Arthur F. Gray, of Danversport, Mass.; fresh-water shells, Prof. R. Ellsworth Call, of Des Moines, Ia.; mosses, Mr. Eugene Rau, of Bethlehem, Pa.; lichens, Mr. H. Wiley, of New Bedford, Mass.; *Algæ*, Mr. Francis Wolle, of Bethlehem, Pa ; *Agaricini*, Prof. C. H. Peck, State Botanist of New York; lower *Fungi*, J. B. Ellis, of Newfield, N. J.

A considerable number of volunteer resident collectors and correspondents have already been secured in various parts of the State, and it is hoped that many others may be added. The following points, as yet unprovided for by resident observers, are particularly important stations; and we shall be glad to correspond with any one who can represent these localities for the survey, or direct its attention to such as they think might be able to do so: (1) the Kansas shore of the Missouri River; (2) the Marias des Cygnes Valley, near the eastern State line; valley of (3) Spring and (4) Arkansas River, near the southern State line; (5) Medicine Lodge; (6) extreme southwestern Kansas; (7) Republican Valley, near the west line of the State; (8) Norton County; (9) Blue River Valley, near the northern State Line.

Correspondence is invited from all interested in the subject of natural history in Kansas. Communications and specimens relating to the survey should be addressed to F. W. Cragin, Washburn College, Topeka, Kansas.

Circulars are in course of preparation, giving directions as to the manner of collection, preservation, and transmitting of specimens best calculated to subserve the objects of the survey, and these circulars will be forwarded to any address on application.

Two reports on the progress of the survey—published in the *Bulletin of the Washburn College Laboratory of Natural History*—have already been completed, and the material for the third is largely in hand.

The following sketch will give a fair idea of the general method of the work and of results thus far attained and those still sought:

To the list of Kansas mammals as given by Prof. M. V. B. Knox, some years ago, the survey has been able to add a number of species, among the most interesting of which, as considerably extending the known geographical distribution of the species, are the Mexican Badger, two specimens of which have been found in central Kansas, and the Free-Tailed Bat, found in the northeastern part of the State. Both are southern species and their occurrence in Kansas is a matter of some surprise. It has also added to the State Fauna the Georgian Bat, and is able to record through the favor of Prof. Snow, the Little Shrew, *Blarina parvula*, from western Kansas. It would call attention also to the long lost Black-footed Ferret, or Prairie Dog-Hunter, of western Kansas, whose rediscovery was recorded a few years since by Dr. Coues, and would urge our collectors and hunters to keep vigilant watch for it with a view to ascertaining its distribution and abundance in the State. Does the distribution of this ferret coincide with that of the Prairie-Dog? The survey is also gathering statistics with a view to determining the exact distribution of the Prairie-Dog in Kansas, and its relations to civilization and agriculture. Is the Prairie-Dog favorably or adversely

affected by the advance of civilization upon him? Have the "deserted towns" of this animal become such owing to a desire to shun observation and molestation by man, or were the migrations which they record induced by desire for better forage grounds, or by other causes? Items of information tending to shed light upon the distribution, increase, or extermination, habits, and economic relations of this and other species of the animals of Kansas are greatly desired. For some of our species the historical material must be gathered at once, or it will never be fully known. With birds, as already intimated, the survey is not concerned.

In Reptiles, perhaps the most interesting discovery is that of a second species of Green Snake, the slender Green Snake, *Cyclophis æstivus*, an austroriparian species, collected by Col. N. S. Goss, at Neosho Falls. Kansas is doubtless the northern limit of this bright-hued, active, southern serpent.

Of Fishes the survey has made considerable collections, mainly of smaller forms. Three species new to science have already been described in its reports, and the pretty little Zebra Fish of the Rio Grande River, known until recently by Girard's imperfect description only, has been re-discovered and fully described from material sent from Ellis, Kansas, by Dr. L. Watson. The Zebra-Fish has since proved to be one of the commonest fishes of western Kansas, scores having been taken from a little stream near Garden City by the writer in two days' collecting last August. The Lamprey Eel of Kansas, parasitic on the Buffalo-Fish, etc., proves to be usually the *Chestnut* Lamprey, and the material collected tends to confirm the suspicion expressed by Jordan and Gilbert in their "Synopsis of Fishes of North America" that this and the Silvery Lamprey may be only varieties of one and the same species.

In Insects, the survey has paid attention to only the order of Locusts, including the grass-hoppers, locusts, crickets, and "devil's horses." Collections have been secured in eastern, central and western Kansas and a report on these will appear in *Washburn Bulletin No. 3*.

A few Spiders, Centipedes, and Scorpions have also been collected and in part determined. Of the first, the great "Bird Spider of Texas," sent us from Chautauqua County, by Mr. Charles Hosford, is the most noticeable; and of the second, the long-legged Forceps—centipede, or "Carpet-Sweeper" (*Cermatia forceps*), from several localities, is quite a unique.

The collection of fresh-water Crustacea is considerable, but is yet to be studied.

In Mollusks, the survey has collected about fifty species of river- and pond-bivalves, some three-fourths of which have been named, and about thirty species of land and fresh-water snails, mostly determined.

In Worms, little has been done; but a most interesting discovery is that of a still unpublished species of fresh-water Polyzoan, common in our creeks, and the first, apparently, recorded from the plains. It is a branching form, a *Fredericella*, and its graceful resupinate sprays grow upon submerged stones and mussel-shells. The short, stout Hair-Worm, *Gordius robustus*, has been found in Waubaunsee County, and one or two other species have been collected but not determined.

No Fresh-water Sponge or Hydroid has yet been found in our Kansas waters. With our Rotifers and Rizopods nothing has yet been done. Some work will be attempted on them another season.

A brilliant red Infusoria, an *Englena* whose specific name now escapes me, I found in August, on a wet mud flat by a shallow pool in Waubaunsee County, in such multitudes as to make a considerable area to appear as though coated with blood. Until within a few years this genus was regarded as a plant. It is not, however, the expectation to undertake much with the Infusoria, as these are so largely cosmopolitan in their distribution.

In Botany the survey has concerned itself with the Cryptogams only. A number of botanists are diligently at work with the flowering-plants, and it is understood that no less than four of these propose to give us independent accounts of the phænogamic flora of Kansas. Further work on the Phænogams is therefore uncalled for.

In the Ferns, collections have been made and two papers published which have added a number of names to the record of Kansas species. Amongst these I may mention the luxuriant Marsh-Fern (*A. Thelypteris*), contributed from Pottawatomie County by Mr. A. McMillan, and the Hardy Lip-Fern (*Ch. lanuginosa*) and the Wright Cliff Brake (*P. Wrightiana*), contributed from Ottawa County by Mr. C. C. Olney. The species and varieties of ferns known to occur in Kansas now number twenty-four.

In Mosses, Fresh-water Algæ, and Lichens, lists have been begun, though the number of species recorded is small, compared with what are yet to be recorded. Among the Algæ, after the large green scums of matted threads (*Spirogyra, etc.*) common in pools and watering-troughs, the most conspicuous is perhaps what may be called the "Swimming-bell Alga" (*Glœotrichia natans,*) which was found in Lake Inman in August, and which seems not to have been previously detected in western North America. The gelatinous frond of this plant has at first the form of an inverted saucer or shallow cup, with margin rolled in beneath. After this has attained a length of two or three inches it sends out long finger-like lobes and becomes very irregular in form, the entire plant sometimes attaining a length of two or three feet. The resemblance in general habit of the young "blubber-cups" to certain of the curious jelly-fish known to the mariner as "sea-blubbers" at once suggests itself, though we must not look for tentacles nor scrutinize in any way too closely; and, as they float in the open spaces left by the confused colony of brown, long-fingered, older fronds, it is easy to fancy them such, floating among the sea-weeds of some quiet bay. Thus do the insignificant lakelets of the plains in the heart of a great continent simulate scenes of the ocean.

In Fungi, the survey has collected over two hundred species, mainly non-parasitic, of which nearly all have been reported in the *Washburn Bulletins*. In this department of the work, Prof. W. A. Kellerman of the State Agricultural College coöperates and has reported about one hundred eighty species of parasitic fungi and thirty-two miscellaneous. Making allowance for the few species

common to these lists, the number of fungi thus far determined in Kansas is about four hundred, a considerable number among them new to science. The number of perishable fungi collected but not determined would doubtless double this number; and the number of fungi that occur in the State is probably not short of two thousand.

Such are some of the results that up to this time have been gained toward the development of the knowledge of the botany and zoölogy of Kansas. Much remains to be done and it is hoped that the aid of every observer in Kansas will be heartily extended to the survey so that the results, based upon an abundance of material, may be full and conclusive; a credit alike to the collaborators and to the State.

ASTRONOMY.

VELOCITY.—III.

EDGAR L. LARKIN.

MOTION IN THE SIDEREAL STRUCTURE.—In (I), this REVIEW, Volume VII, page 764, we presented the fact that a body falling on a straight line from an infinite distance to the Sun, not meeting resisting medium, will strike with a velocity of 382.956 miles per second. This is the maximum velocity that can be imparted to a falling mass by the attraction of the Sun and in these notes is termed G. It is the most valuable constant in nature yet detected by mathematicians. By its use, rates of motion generated by solar gravity in the remotest solitudes of space can be computed with little work.

Since G=velocity of impact or the Sun from infinite distance, terminal motion from any finite distance can be determined with ease by means of G in simple formulas. On page 766 we made calculation of velocities of collision from several finite distances ranging between 1 and 20,000,000 solar radii. Because it is difficult for cosmic masses to strike the Sun, few collide while many dash around it on orbits, we gave (Volume VIII, page 188,) velocities of bodies that escape collision and retreat to interstellar voids. These discussions relate to motion displayed near the Sun; but we desire to make research on velocities observed in that small part of the sidereal edifice visible in telescope.

Assume a stone at rest at an infinite distance from the Sun, and let it fall on a straight line, then since we know G, the velocity of the falling body while passing a point at any finite distance can be determined by making G a factor.

Thus:—if a mass from infinite distance approach the Sun, its velocity at any finite distance expressed in solar radii is equal to G multiplied by the square root of the quotient obtained by dividing the distance by its square. If we call

the radius of the Sun r, the Earth's distance is 214r, whose square =45972. Then—214÷45972=.046638 whose square root=.06829×382.956=26.15 miles per second velocity acquired by the mass at the orbit of the Earth on arrival from a distance that is infinite. Solar gravity acts on all cosmical bodies, which would move toward the Sun unless restrained by an opponent able to counteract attraction. Such energy is centrifugal tendency, a tendency generated by velocity. It is known how great orbital motion is required to evolve centrifugal tendency equal to gravity at any distance; hence the ratio of such velocity to velocity derived from fall from infinite distance can be ascertained.

Having found this ratio, it can be extended to any depth of space, and motion computed. If a body revolve around the Sun with velocity sufficient to cause centrifugal tendency to equal centripetal, such velocity is equal to G multiplied by the square root of the quotient obtained by dividing the distance at which it revolves by *twice* its square. We have for the motion of the Earth—twice the square of 214=91945, when 214÷91945=.002332 whose square root =.0483× 282.956=18.49 miles per second orbital velocity necessary to keep it from fall-toward the Sun. But, 26.15÷18.49=1.414213, hence the sought for ratio of orbital velocity at a distance of revolution where such motion evolves centrifugal tendency equal to gravity, is to velocity of fall ot the same distance from the Sun of a falling body that begun its fall at an infinite distance as 1 is to 1.414213.

Now, 1.414213 is the square root of 2, hence this ratio of velocities must be correct, for if we take the square roots of quotients derived from dividing a number by the square and twice the square of another, this relation of roots must inevitably obtain. This ratio may be said to be a characteristic of gravity and motion and exists wherever matter does, or is at liberty to move in obedience to gravitation. Let us again note from I and II the properties of this square root of 2. If we should dig a well from the surface to the centre of the Sun and drop in a stone, it would reach the centre with a velocity of 270.79 miles per second. But this is equal to 382.956÷2.414213, whence a mass falling from the surface to the centre of the Sun will acqure seventy per cent of the velocity attained on reaching the solar surface had it been falling since the "beginning." Again—a body taken into space distant 1 radius of the Sun and let fall, will make impact with this same velocity—270.79 miles per second. Or,—a stone a few miles above the Sun's surface (in absence of retarding matter) having orbital velocity=270.79 miles per second, will not fall but make revolution like a satellite; or should the Sun's equator revolve with that rate, masses lying upon the surface would be without weight. If a comet move with velocity equal to the square root of 2,—velocity of a planet at same distance where centrifugal tendency and gravity balance, being equal to 1, then will the comet pass round the Sun and retire never to return. Should its motion be less, say 1.38 or similar velocity, then it will fall on some form of ellipse and make future circuits. In short—velocity on closed is to velocity on open conics; or orbital velocity at finite is to velocity of fall from infinite distance as 1 is to 1.414213. We extend this principle to the sidereal heavens seeking to learn what rate of motion solar gravity

is able to cause among other suns so distant that their light requires centuries to traverse the mighty wastes between. We present this table of distances and velocities. Column I gives distances from the Sun's centre in trillions of miles, II, orbital velocities in miles per second of bodies in revolution around the Sun where centrifugal tendency equals gravity; III, same in miles per hour; IV, falling velocities acquired by bodies that fall from infinite distance, on arrival at orbits of revolving bodies; V same in miles per hour:

I.	II.	III.	IV.	V.
Distance.	Orbital Velocities, Miles per second.	Same, Miles per hour.	Falling Velocities, Miles per second.	Same, Miles per hour.
1.	.1788	644.	.253	910.
5.	.0797	287.	.1125	406.
10.	.0563	203.	.0797	287.
16.	.04474	161.	.06327	228.
20.	.039	140.	.0563	203.
32.	.03163	114.	.04474	161.
40.	.02757	99.	.039	140.
64.	.0224	80.	.03163	114.
80.	.019	68.	.02757	99.
128.	.0158	57.	.0224	80.
256.	.01117	40.	.0158	57.
512.	.0079	28.	.01117	40.
1,024.	.005586	20.	.0079	28.
2,048.	.0039	14.	.005586	20.
4,096.	.00276	10.	.0039	14.
8,192.	.00195	7.	.00276	10.
16,384.	.00138	5.	.00195	7.

This table was calculated by employing G once to find falling velocity at five trillion miles as indicated in formula. This was all that was required for having falling velocity at a given distance, orbital velocity was obtained directly by dividing by 1.414213. Both velocities being known, the whole table may be made in a short time by simple division, or by proportion or by interpolating.

Thus: orbital at five, is the same as falling velocity at ten trillion miles, and so on. This must be true since velocity at a distance divided by the square root of 2 equals velocity at twice the distance, a result that obtains because gravity varies inversely as the *square* of distance. But one cannot fail being impressed with the majesty of the Sun, or his mighty power of attraction.

We see that a body distant twenty trillion miles must move with a velocity of .039 miles per second or 140 miles per hour in direction at right angles to radius vector, or it is falling toward the Sun. But twenty trillion miles is the distance of Alpha Centauri, the nearest star. Ignoring the mass of Alpha Centauri let us call it a material point, then it has this velocity which is at a minimum, and its path is curved this way. This follows unless indeed, there is on the other side

of Alpha a Sun more massive than our own. If there is, then Alpha of the Centaur does not traverse a path of *regular* curvature. Neither does any other Sun owing to mutual attraction. Assigning to the nearest sun to ours a mass equal to the solar, assume our Sun to dwindle to a point, then *its* minimum velocity is 140 miles per hour.

Continuing research, let us recede to forty trillion miles, when we find that a mass there must move on an orbit ninety-nine miles per hour or fall toward the Sun. Seeking to escape solar gravity we sink in space to the appalling depth of 13,384 trillion miles, when behold! we still are dominated by his colossal power. Indeed! a sun at that distance of must fly on a gigantic curve five miles per hour or yield to solar force and fall. Or, having reached that point from infinite distance its falling velocity would be seven miles per hour. Light requires 2,880 years to traverse 16,384 trillion miles. But, a sun at that distance may not obey ours, its varying path may be determined by others nearer or more massive, and by none of these long at a time, since all suns shift position. Some suns are seen to move with greater velocity than theory demands, hence let us make further research in this exciting field.

New Windsor, Ill., January, 1885.

CAUSE OF SOLAR HEAT.

PROF. RICHARD A. PROCTOR.

Professor Young, of Princeton, in a recent address at Philadelphia, expressed his belief that the contraction theory of the sun's heat is the true and only available theory. I believe so, too, and my object in the present paper is to dwell upon the significance and interest of this remarkable interpretation of the solar mechanism.

Of course it is known to all that the old theory according to which the sun's heat is due to combustion ("doubt that the sun is fire," said Shakespeare, as if the doubt was the quintessence of absurdity) has long since been rejected as futile. A mass of the best combustible material, equal to the sun in quantity, would be burned out at his actual rate of emission—if it could burn right out—in about five thousand years. In like manner the idea of the sun as an intensely hot body simply radiating its heat into space, as a piece of white-hot iron does, without any process of combustion, has had to be rejected. Even if the sun were formed of matter possessing the high specific heat of water which has the remarkable property of giving out more heat in cooling than any other natural substance known (and only one or two artificial substances surpass it in this respect), even then the sun's emission of heat at his present rate would not cover more than about 5,500 years. Processes of chemical change have been suggested as affording the true source of solar heat; but they in turn have had to be rejected as altogether insufficient. It is unnecessary to touch on the supposed origin of solar heat in the

gathering in of meteoric bodies, for in reality this process belongs to the contraction theory; it has, however, been abundantly demonstrated that the actual amount of sun heat which could be derived from the drawing in of matter now outside the solar globe can be but very small. We are left, in fine, no recourse—so far as our present knowledge extends—but to regard the process of contraction taking place within the solar globe as the true source of all or very nearly all the heat and light which the sun emits, and therefore of every form of force and life on this earth and on whatever other members of the solar system may be the abode of life or a scene of the display of any forms of force not derived from internal heat and energy.

But now at the very outset, what a mighty mystery is thus unveiled! It seemed wonderful enough to recognize in what we fondly call inert matter the source of the energies which guide the heavenly bodies in their motions. I know indeed nothing more mysterious (more hopelessly mysterious, one might say, if one could limit the possibilities of future research) than the mystery of gravity. It has been said, and truly said, that

> Nature and Nature's laws lay hid in night,
> God said, "Let Newton be," and all was light.

All was indeed light where before men had been groping in darkness. But outside the region where they had thus been searching, far vaster regions of darkness were revealed. A veil was lifted and one of nature's mysteries was interpreted, but a more impenetrable veil was seen beyond, which as yet no man has even hoped to lift. What greater mystery can there be than this, that matter acts where it is not? The sun on the earth and all his planets, the earth on the moon, Jupiter and Saturn on their world systems, planet on planet, star on star, nay, every particle of matter on every other throughout infinity of space. And not only so, but time apparently annihilated as well as distance. For it has been shown that unless the force of gravity traversed distance with far greater velocity, nay, with many times the velocity of light (187,000 miles per second), the whole mechanism of the solar system would long since have gone wrong. Nor has it yet been shown how minute the time intervals are in which practical infinities of distance are traversed by this all-pervading attractive action.

And now we find that not only is "inert" matter thus intensely, one may say infinitely, energetic, as a cause of motion, but that it is the real source of the light and heat, which are in effect the very life of the universe itself. Within our own earth, the movements we call earthquakes, as well as all such disturbances as volcanic eruptions, geysers, and so forth, are all primarily due to the process of steady contraction taking place under the action of terrestrial gravity, though of course the proximate cause of each such disturbance is the heat generated during the process of contraction. In each planet, no doubt, similar processes are taking place, with greater or less energy according as a planet is younger or older. And now we see the mighty mass of the sun, steadily by its gravitating energy generating heat, whose emission is in fact the very life of the solar system. In other

words, there resides in mere matter, in what we have so long and so idly called inert matter, the real source of every kind of movement, of every kind of life, within the universe itself. For, what is true of our sun is true of his fellow suns, the stars; not only of the thousands we see, but of the tens, the hundreds of millions revealed by the telescope, and of the millions of millions of galaxies of suns which doubtless exist beyond the domain surveyed by our most powerful telescopes.

But, turning from this stupendous, one may truly say, this awful mystery, which seems to present gravitation as in a sense associated directly with the great first cause, we note that there are many minor mysteries about the theory that solar gravitation is the true source of solar heat.

In the first place, many find it difficult to understand how the shrinkage of even solid matter, still less that of vaporous matter, can lead to the generation of heat. Yet in reality, to any one who rightly apprehends the principle of the conservation of energy, it will be obvious that the heat generated as the solar gravity draws inward any portion of his envelope of vapors, and in so doing necessarily diminishes the volume of that portion, must be exactly the equivalent of the heat which would be required to reverse the process, and so to restore by expansion that portion of vaporous matter to its original volume. A real difficulty arises for a moment when we inquire why the heat generated momentarily by the forces tending to produce contraction is not momentarily employed in producing equivalent counter expansion. We must remember, however, that a portion of the heat generated must necessarily be radiated away into space, simply because it is exposed to the cold of space. One may compare the case to that of a pump so constructed that if all the water raised remained in a certian vessel round the place of exit, the weight of water would serve as a source of power to keep the pump working. In such a case, were friction entirely gotten rid of, the pump would work forever. But if the vessel were perforated so that all the time a portion of the water escaped, this would no longer happen. The heat constantly generated by the enforced process of solar contraction does in part escape; a portion continually undoes part of the work of contraction by causing expansion, but the portion which, as we see and feel, is continually escaping from the sun, causes a portion of the contraction to remain uncompensated. Thus the sun, as a whole, continues steadily contracting and steadily emitting heat. Nor will he cease to contract until he ceases to emit light and heat, or in other words, until he ceases to be the beneficent light-giving center of the solar system.

But the most perplexing mystery in connection with the contraction theory of the sun's heat is that the sun and the earth seem to tell a different story in regard to the amount of heat which has been poured forth. Judging from the sun's apparent size, it would seem as though not more than 20,000,000 of years of solar work, at the sun's present rate of working, could possibly have been done; for if he had gathered in his mass from any distances, however large, that would be the absolute maxim of energy represented by the process of contraction to his present apparent size. But the earth's crust seems to tell us of a much

longer period of sun work than this. If Dr. Croll, of Glasgow, whose results Sir Charles Lyell accepted, has rightly estimated the amount of work so done on the earth, it can not represent less than one hundred millions of years of sun work. How can we explain the discrepancy? Prof. Young accepts the sun's evidence as it stands, making only the provision that if in past ages the sun was exposed to some violent shock, as by collision with another sun, more heat would have been generated. Dr. Croll takes the earth's evidence alone, and considers that there must have been such collision. For my own part, I consider it clearly proved in other ways (and it comes in well to remove this particular difficulty) that the sun's real globe is very much smaller than the globe we see. In other words, the process of contraction has gone on further than, judging from the sun's apparent size, we should suppose it to have done, and therefore represents more sun work. According to this view, however, the sun's future would last many millions of years less than it would if his apparent size is not far from his real size. But the limited allowance of future work we should assign to him—a few millions of years' work at the outside—is estimated on the assumption that only such densities as we recognize in terrestrial substances can be attained within the sun's mass. It may well be that under the conditions there existing, matter may attain densities far greater than we find here. If so, the sun's duration as the life-giving center of a family of worlds may be far greater than has hitherto been supposed.—*New York Tribune.*

SUN AND PLANETS FOR FEBRUARY, 1885.

W. DAWSON, SPICELAND, IND.

The Sun's R. A. at noon, February 1st, is 21h. 2m.; and Declination 16° 54′ S., making the day about fifty minutes longer than December 31st, when the Sun's Declination was 23½° S. Spots on the Sun were few and small in the first half of January. Two pretty good-sized ones near east edge on the 17th.

The planet Saturn occupies pretty nearly the same place among the stars that it did in December and January—rather more west. Its retrograde motion continues very slowly till the 16th, when it assumes the eastern, or direct, motion of R. A. The ring is now about its widest and will continue so with little diminution for several months. It souths at 8:16 P. M. on the 1st, and at 6:30 on the 28th.

Jupiter rises at 7:00 P. M. on the 1st, some north of east. It is very bright and can easily be known from any other star. Regulus in the Sickle is a few degrees above this planet. They will be near together in latter part of March. Jupiter will be in opposition to the Sun on the 19th of February, and its motion is retrograde, which accounts for its approach to Regulus.

Any person having a telescope, or even a spy-glass, will be interested in observing this great planet with its moons and belts, now it is so near us in the

evening. Mars comes in conjunction with the Sun (on the other side) in the morning of the 11th.

Venus is still a low Morning Star away southeast. Mercury will be just south of it on the 11th. Uranus is still between Eta and Gamma Virginis. Neptune is nearly where it has been for several months, a few degrees southwest of Pleiades.

METEOROLOGY.

METEOROLOGICAL SUMMARY FOR THE YEAR 1884.

PROF. F. H. SNOW, UNIVERSITY OF KANSAS.

The most notable features of the year 1884, as observed at Lawrence, were the low mean temperatures of the spring, summer, and winter months; the high mean temperature of the autumn months; the very large rainfall, which came within half an inch of the extraordinary precipitation of the year 1876; the unusual percentage of cloudiness; the low velocity of the wind; the decided preponderance of south winds over north winds; and the increased percentage of atmospheric humidity.

TEMPERATURE.—Mean temperature of the year, 51.30°, which is 2.11° below the mean of the sixteen preceding years. The highest temperature was 98°, on July 8; the lowest was 21.5° below zero, on the 5th of January, giving a range for the year of 119.5°. Mean at 7 A. M., 45.69°; at 2 P. M., 59.40°; at 9 P. M., 50.04°.

Mean temperature of the winter months, 24.19°, which is 5.71° below the average winter temperature; of the spring, 51.41°, which is 2.41° below the average; of the summer, 73.05°, which is 3.05° below the average; of the autumn, 56.59°, which is 3.01° above the average.

The coldest month of the year was January, with mean temperature 20.99°; the coldest week was January 1st to 7th, mean temperature 0.07° below zero; the coldest day was January 5th, mean temperature 12° below zero. The mercury fell below zero fourteen times, of which seven were in January, one in February, and six in December.

The warmest month was July, with mean temperature 76.93°; the warmest week was July 20th to 26th, mean 79.66°; the warmest day was July 8th, mean 80.37°. The mercury reached or exceeded 90° on twenty days (one less than half the average number), viz., two in June, ten in July, three in August, and five in September.

The last hoar frost of spring was on April 24th; the first hoar frost of autumn

was on October 8th, giving an interval of 167 days, or nearly six months, entirely without frost. The average interval is 154 days.

The last severe frost of spring was on April 8th; the first severe frost of autumn was on the 23d of October; giving an interval of 198 days, or nearly seven months, without severe frost. The average interval is 199 days. No frost during the year caused damage to crops of grain and fruit. The low temperatures of January were generally destructive to peach buds.

RAIN.—The entire rainfall, including melted snow, was 43.70 inches, which has been but once exceeded on our seventeen years' record (in 1876) and is 9.05 inches above the annual average. Either rain or snow, or both, in measurable quantities, fell on 115 days—eleven more than the average. On nine other days rain or snow fell in quantity too small for measurement.

There was no approach to a drouth during the year, the longest interval without rain in the growing season being thirteen days, from July 30 to August 12.

The number of thunder showers was thirty-five. There was but one light hail storm during the year—on May 17th.

SNOW.—The entire depth of snow was 29 inches, which is 8.62 inches above the average. Of this amount twelve inches fell in January, two inches in February, one inch in March, six inches in April, one and a half inches in November, and six and a half inches in December. Snow fell on twenty-one days. The last snow of spring was on April 21st; the first snow of autumn was on November 18th—ten days later than the average date.

FACE OF THE SKY.—The mean cloudiness of the year was 47.56 per cent, which is 3.09 per cent above the average. The number of clear days (less than one-third cloudy) was 146; half clear (from one to two-thirds cloudy) 116; cloudy (more than two-thirds) 104. There were seventy-five days on which the cloudiness reached or exceeded 80 per cent. There were thirty-three entirely clear and forty-three entirely cloudy days. The clearest month was October, with a mean of 34.19 per cent; the cloudiest month was December, mean 66.34 per cent. The percentage of cloudiness at 7 A. M. was 53.89; at 2 P. M., 49.76; at 9 P. M., 39.03.

DIRECTION OF THE WIND.—During the year, three observations daily, the wind was from the south-west, 266 times; north-west, 252 times; south-east, 201 times; north-east, 197 times; south, 76 times; north 46 times; east 37 times; west 23 times. The south winds (including south-west, south, and south-east), outnumbered the north (including north-west, north, and north-east), in the ratio of 543 to 495.

VELOCITY OF THE WIND.—The number of miles traveled by the wind during the year was 131,188, which is 7,421 miles below the annual average for the eleven preceding years. This gives a mean daily velocity of 358.44 miles and a mean hourly velocity of 14.93 miles. The highest hourly velocity was 75 miles,

on June 25th; the highest daily velocity was 990 miles, on the 19th of January; the highest monthly velocity was 14,368 miles in January. The three windiest months were January, March, and April; the three calmest months were June, July, and August. The average velocity at 7 A. M. was 14.62 miles; at 2 P. M., 16.91 miles; at 9 P. M., 14.27 miles.

BAROMETER.—Mean height of barometer column, 29.111 inches, which is 0.006 inch above the annual mean. Mean at 7 A. M., 29.133 inches; at 2 P. M., 29.091 inches; at 9 P. M., 29.109 inches; maximum, 29.881 inches, on January 4th; minimum, 28.451 inches, on March 27th; yearly range, 1.430 inches. The highest monthly mean was 29.333 inches, in February; the lowest was 29.002 inches in April. The barometer observations are corrected for temperature and instrumental error only.

RELATIVE HUMIDITY.—The average atmospheric humidity for the year was 72.6; at 7 A. M., 83.1; at 2 P. M., 55.8; at 9 P. M., 78.8. The dampest month was September, with mean humidity, 77.8; the dryest month was March, mean humidity, 65.0. There were twenty-eight fogs during the year. The lowest humidity for any single observation was 15 per cent, on March 12th.

The following tables give the mean temperature, the extremes of temperature, the number of inches of rain and snow, the number of rainy days, the number of thunder showers, the mean cloudiness, the relative humidity, the number of fogs, the velocity of the wind, the mean and extreme barometer heights for each month of the year 1884, and a comparison with each of the sixteen preceding years:

YEAR 1884.

1884.	Mean Temperature.	Max. Temperature.	Min. Temperature.	Rain—Inches.	Snow—Inches.	Rainy Days.	Thunder Storms.	Mean Cloudiness.	Mean Humidity.	Number of Fogs.	Miles of Wind.	Mean Barometer.	Max. Barometer.	Min. Barometer.
January	20.99	57.0	-21.5	1.28	12.0	7	0	41.42	73.9	3	14,368	29,313	29,881	28,735
February	28.03	57.0	- 1.0	1.13	2.0	8	1	54.33	72.3	1	11,651	29,158	29,469	28,587
March	41.56	73.0	12.0	2.73	1.0	9	5	58.87	65.0	2	14,229	29,054	29,465	28,451
April	50.42	76.5	28.5	5.62	6.0	13	4	55.76	65.9	1	13,954	29,001	29,321	28,495
May	62.24	85.0	36.0	3.57	0.0	12	2	50.54	68.9	2	9,978	29,046	29,299	28,689
June	71.07	92.0	48.0	3.81	0.0	12	7	38.78	71.8	1	6,806	29,065	29,270	28,831
July	76.93	98.0	60.5	5.18	0.0	15	5	41.67	71.7	1	8,733	29,004	29,289	29,809
August	71.14	92.5	47.5	5.49	0.0	11	4	48.16	77.8	3	9,392	29,110	29,405	28,849
September	70.36	92.0	48.0	9.15	0.0	8	5	40.00	76.3	3	11,409	29,037	29,404	28,810
October	57.87	85.0	31.0	2.38	0.0	8	2	34.19	74.8	5	10,150	29,179	29,568	28,712
November	41.53	70.0	9.5	0.80	1.5	3	0	40.77	72.0	5	10,503	29,175	29,563	29,634
December	23.54	59.5	6.5	2.56	6.5	9	0	66.34	80.0	1	10,015	29,189	29,666	28,618
Mean	51.30	78.1	25.4	3.64	2.4	10	3	47.56	72.6	2	10,932	29,111	29,467	28,685

SEVENTEEN YEARS: 1868—1884.

YEAR.	Mean Temperature.	Max. Temp.	Min. Temp.	Hot Days (above 90°.)	Zero Days.	Days between severe frosts.	Rain—Inches.	Snow—Inches.	Rainy Days.	Thunder Storms.	Mean Cloudiness.	Mean Humidity.	No. of Fogs.	Miles of Wind.	Mean Barometer.
1868.....	53.36	101.0	-16.5	43	7	160	37.48	27.50	77	.....	42.35	.....	.....	.....	.....
1869.....	50.99	96.0	- 5.0	23	2	167	38.51	18.00	105	33	49.23	78.2	19	.....	29.103
1870.....	54.50	102.0	-10.0	51	6	197	31.32	9.50	100	27	47.88	68.4	13	.....	29.097
1871.....	54.30	103.0	- 6.0	48	8	218	33.23	29.75	120	24	47.37	65.9	6	.....	29.076
1872.....	51.90	97.0	-18.0	45	16	192	32.63	23.25	116	40	44.33	64.4	11	.....	29.112
1873.....	52.71	104.0	-26.0	48	9	165	32.94	26 50	101	17	42.46	64.0	6	154,508	29.093
1874.....	54.20	108.0	- 3.0	58	2	187	28 87	43.00	99	20	45.54	65.7	14	145,865	29.121
1875.....	50.60	99.0	-16.5	32	12	196	28.87	5.00	106	21	44.81	66.7	5	145,316	29.102
1876.....	52.76	98.0	- 5.0	36	4	179	44.18	25.75	102	29	41.27	66.8	4	148,120	29.102
1877.....	54.16	99.0	- 9.0	20	3	217	41.09	15.50	126	39	47.12	72.6	11	113,997	29.117
1878.....	55.33	98.0	- 6.0	35	7	228	38.39	25.50	107	38	40.65	70.2	5	125,793	29.067
1879.....	54.67	99.5	-16.0	48	13	203	32.68	10.35	90	36	40.01	67.1	10	124,758	29.127
1880.....	54.01	101.0	-12.0	41	2	211	32.65	7.00	89	29	40.15	67.9	18	146,039	29.123
1881.....	54.65	104.0	- 8.0	68	6	210	33.27	32.50	110	31	47.42	70.1	11	141,430	29.103
1882.....	54.94	105.0	- 6.5	40	1	232	27.60	18.00	102	26	45.41	68.6	14	137,736	29.113
1883.....	51.66	96.5	-14.0	26	8	217	40.65	12.50	106	32	45.24	69.7	18	141,164	29.135
1884.....	51.30	98.0	-21.5	20	14	198	43.70	29.00	115	35	47.56	72.6	28	131,188	29.111
Mean.....	53.29	97.8	-12.8	41	7	199	35.18	20.87	104	30	44.65	68.7	12	137,591	19.106

In the column of minimum temperatures a dash indicates temperature below zero.

CORRESPONDENCE.

THE NEW ORLEANS EXPOSITION.

EDITOR REVIEW:—The Christmas holidays gave our city teachers a much needed vacation, which was improved by about forty of us in visiting the New Orleans Exposition. Of course we went by way of the Memphis Short Line, with buffet sleepers the whole distance. As the ground was covered with snow and ice, and the mercury only barely above zero when we started, little can be said of the picturesqueness of the scenery, the charms of the climate or the verdure and productiveness of the soil along the route, either in Kansas, Missouri or Arkansas. At Memphis we found the Mississippi full of heavy floating ice, and from that city for the greater portion of the way to New Orleans old winter had locked everything up in icy bonds, so that so far as appearances went the "Sunny South" had fully acknowledged his sway. A few holly-trees, some pines, some canes, and, as we approached the Gulf, some magnolias and live-

oaks, retained their green foliage, otherwise all the trees were as bare of leaves and the grass as dead as in the North.

Cotton fields here and there, half picked, broke the monotony of dense forests and canebrakes; farm houses and cabins showed themselves at long intervals; towns and villages were almost unknown; the railway stations were mostly single shanties without even the accompaniment of the universal saloons and eating houses; animal life was scarce, and as for people, it was a wonder, as one of our professors said, where the South, if this was a sample of it, found the men to make the resistance it did to the march of our armies in the late war. The morning of our arrival in New Orleans found us amid sugar plantations, orange groves, blooming roses, well advanced gardens, barefooted negroes and other signs of a tropical climate. The weather was warm, but the air was moist and murky.

About 9:00 o'clock we rolled into the city, passing over miles of low, flat, swampy outskirts with grassy streets cut into miry channels by the teams plunging through them. On the right we could see the Exposition buildings in the distance, with the chimneys and even the hulls of the steamers on the river beyond looming up high above the intermediate territory. On the left more swamps with palmettoes, moss-burdened oaks and cypresses, and tangled vines, extending clear to the margin of Lake Ponchartrain. In front, mud, smoke, white frame houses with enormous double porticoes, negroes, oranges, bananas, French women, blooming dooryards with high close fences, and ditches full of filthy water, made up the landscape. At the depot we took carriages and omnibuses and were jolted to our hotel over the roughest streets imaginable. If any one of our readers was ever sick while in the army and compelled to ride in a government wagon over the corduroy roads of Virginia, he will have a pretty good idea of this closing ride, otherwise he cannot, as nothing else ever equaled it for discomfort. The paving of the streets, where any has been done, consists of blocks of stone of uneven sizes and shapes, with—apparently—an omission of every other one.

While growling, I may as well say that if disease really does ever come from dirt there should not be a well known person in New Orleans at present, for it is impossible to conceive of streets more utterly foul and filthy. Not only is there an unmeasureable vastness of mud, hardly barred off from the sidewalks by the curbstones, and swashed along sluggishly by the oozy torrents in the gutters, but every butcher, baker, saloon-keeper, etc., who has a bucket of slops to dispose of brings it to the edge of the sidewalk and pitches it into the middle of the street. You have mud in Kansas City, but it is so clean compared with New Orleans mud that you could absolutely cleanse yourself in it after wading about in the latter for an hour or two. Inasmuch as I learn that this city is quite healthy now, I am prepared to discard the theory that dirt has anything to do with originating disease, and propose to protest against our Dr. Fee's sanitary precautions as unnecessary and possibly baneful.

Having said so much in disparagement of this city, I will now say something

to its credit. I had heard much of extortionate rates for rooms, board, meals, etc., but after a week's stay I can candidly say that I have found nothing of the kind. The hotel charges remain as formerly, from five dollars a day down to two and one-half, according to style, location, etc. No one need pay out more than three dollars per day for very comfortable living, with room to himself and meals at a French restaurant. With economy and by doubling up in rooms, this figure can be considerably reduced. One can go out to the exposition grounds—four miles—on a steamboat at twenty-five cents for the round trip, landing at the side entrance to the grounds, or on the street cars for five cents each way, getting off at the main entrance. He can ride out to Lake Ponchartrain on the steam cars by two routes, five miles or more, for twenty cents the round trip, or he can, if he is as lucky as the teachers of the northwest, take an excursion to Mobile and back, with a stop at Jeff. Davis' place, Beauvoir, and a fish dinner at Pass Christian, for two dollars; or he can take a steamer down to the Jetties and back with a sail on the Gulf, for six dollars, including berth and meals on the boat for twenty-four hours; so that you see the rates are not so very exhorbitant after all.

As to the city, it is much like all other cities. Among its curiosities are the old French town and the French market, the levee with its shipping from all parts of the world; its cotton exchange, its shot tower, cathedral, etc.

Now for the Exposition. So much has been written about it that one hardly knows what to say that will be new. Everybody knows that it is located on the flats above the city, and that one hundred and seven acres are inclosed for its uses and purposes; that the main building covers thirty-three acres of ground, and that about two millions of dollars have been expended upon it and the other buildings. These things are well known and yet the people who know them may not realize how large this main building is. It might astonish some of them to appreciate the fact that it is as large square as from 8th to 12th Street in Kansas City, or that the music hall, large enough to seat 11,000 persons on one floor, may be passed unnoticed day after day, although nearly in the center of the building, if you happen to enter by any other than the grand front door. Constructed of glass and iron, it is both light and strong, and as a grand architectural work it is an admirable and marvelous success. It, as well as the government building, is the work of a Swedish architect named Torgerson.

The management of the whole affair, from its conception to the present day, has been concentrated in the person of Major A. E. Burke, editor of the *Times-Democrat*, of New Orleans. He has done in less than one year and with $2,000,000, what the Philadelphians were glorified for accomplishing in four years with more than three times as much money. He has put his whole soul into it and, for that matter, his body too, for he has worn himself out more in these few months than he would have done in ordinary business in as many years. As a man who knows something about expositions, in a small way, I pronounce the management of this New Orleans affair a wonderful success. The delays and hindrances are less noticeable than usual, in proportion, and are due far more largely to the lethargy of the citizens of the city and of the people of the South,

who are chiefly to be benefitted by it, than to any other cause. They could and should have put their money into it liberally; at least they should have paid up their voluntary subscriptions—and not have allowed its credit to be destroyed before its completion; they should have provided better means of access, both for freight and visitors, and they should patronize it better themselves.

But even as it is, it is a better exposition in many respects than this country ever saw. Any visitor who undertakes to see all that is even now well presented —omitting all unfinished exhibits—in one week will fail to do it justice. Any visitor who is interested in any special subject and desires to study it in detail, can spend days on that alone, whether it be ores, minerals, products of the soil, manufactured articles, natural history, archæology, machinery, inventions, art, educational facilities, or progress and results in any other line. Every State and Territory is fully and excellently represented in all these respects, and while some few are yet in an unfinished condition, it is the verdict of all who visited it that these exhibits far excel in size and manner of arrangement those at the Centennial at Philadelphia in 1876. To be personal and candid, I will say that Nebraska seems to take the lead of all in the magnitude and the tastefulness of her display, while Kansas comes next. Missouri has a striking array of packing-boxes, barrels, bales, etc., besides a quantity of freight yet remaining at the depots, which when arranged as contemplated will be highly creditable to Major Hilder and his assistants. Of course the $2,000 or $3,000 raised for this purpose, mainly in St. Louis, will not enable them to make much of an effort to compete with States whose legislatures and private citizens furnished their commissioners with from $5,000 to $25,000 to give an adequate representation.

The display by the Interior and other departments of the Government is absolutely superb, and one who has not visited the Patent Office, Smithsonian Institution, Bureau of Education, Coast Survey, Signal Office, Agricultural Department, Post Office Department, National Museum, Fish Commission, etc., will be fully repaid by these alone for a trip to New Orleans. I am not certain that he will not be better satisfied here, because he can see the best items of all these collections, all under one roof, and thus avoid the fatigue of looking them up in buildings scattered all over Washington City.

If he has a taste for natural history, not fully gratified by the specimens in the Government and State displays, he can step into the gallery and there find the vast collection of Prof. H. A. Ward, of Rochester, which is unequaled in the country. In this he will find restorations and casts, life-size, of the mammoth or fossil elephant, the *Glyptodon clavipes*, the *Megatherium*, the *Mylodon robustus*, and the Irish Elk, besides skeletons, beautifully articulated and mounted, of man and all the Simian family, side by side; birds, fishes, reptiles, etc. Many of these cannot be seen elsewhere in the United States, and Prof. Ward has never before drawn so largely upon his museum for an outside exhibition.

In the main building other nations besides the United States are represented, such as Mexico, Turkey, Honduras, Japan, etc.

To those who are fond of machinery we commend Division B, an iron exten-

sion of the main building, 600x220 feet, filled with machinery for picking, ginning and pressing cotton and also wood-working machines; beyond this another vast room 600x60 feet for heavier machinery, such as saw-mills, etc. Adjoining this, in the main building, are found all kinds of milling machinery; also the exhibits of the Willimantic, Coates, Clark, and Whitin spool cotton companies; the first-named occupying seventeen spaces, or about 200 feet, with the various machines employed in manufacturing spool thread, all in full operation, with crowds of interested spectators watching the successive processes the cotton passes through, from the raw staple to the spooled thread. Near by are the Corticelli Silk Company's headquarters, where can be seen everything connected with the manufacture of spool silk, from the silk-moth, the egg, the silk-worm the cocoon, the reeling of the silk from the cocoon, the spinning, winding, the to coloring, spooling, etc.

Going back to the machinery, we find nearly in the center of the main building the motive power which keeps all the other machinery, as well as the dynamos for the electric lights and electrical display in motion. Principal among these engines is the huge Corliss engine set in operation on the opening day by an electric signal from President Arthur from his room in the White House; but there are nearly a dozen others, aggregating over 4,000 horse-power, grouped together in that locality. Near these is a wonderful display of sugar machinery, railroad engines and cars of all kinds and other heavy machinery, including some very old-fashioned locomotive engines and an electric railway of the most recent date. The ice machines are by no means the least interesting objects, especially to the people of the south, and there are specimens of several patterns, besides refrigerators in all styles and sizes.

In agricultural machinery the display is comparatively light, and I think that I have often seen more of all kinds on exhibition at the Kansas City Expositions.

The electric light is a success. Most of the principal companies of the country are employed to furnish light, such as the Brush, the Edison, the Fort Wayne, and a home company. Thousands of electric lamps, inside and outside of the buildings, give ample light for all purposes, so that visitors who can not go out in the day time can see just as well at night. The Brush Company have the lighting of the government building where the National and State exhibits are displayed, and employ six of their largest dynamos for generating the electricity needed for the 3,600 lights furnished. The Edison Company light the Main Building and Agricultural Hall with over 4,000 incandescent lamps, and have twelve dynamos operated by six engines of 125 horse power each, with a capacity of over 6,000 lights. When the Art Hall is finished this company is to light that also. The Fort Wayne Company light the outside towers—about ten in number—including those at the entrance to the grounds and buildings, also the sheds, stables, etc. These towers are very handsome, being light, ornamental in appearance, and very strong. One of them, placed at the "Lake," is of 100,000 candle power—said to be the largest single electrical light in the world. The home

(Louisiana) Company furnish 800 arc lights in the Main Building. Collectively, this electric system is the largest ever in operation.

Among the myriads of objects of interest, one which attracted my attention and excited my interest, was a white bronze statue, about fifteen feet high, of a private soldier on his post, musket in hand, intended for either street, park, or cemetery purposes. It is admirably done, both in conception and execution, and I should like to see it placed on one of our principal crossings—say at the junction of Main and Delaware streets, at Ninth. It would be an appropriate thing for our citizens and the Grand Army to do, and it can be done for not exceeding $2,000.

Among the things for which Missouri may claim credit, is the time ball, constructed and put in operation by Professor H. S. Pritchett of Washington University, St. Louis. Every day at 10 A. M. this ball is dropped from the principal tower of the Main Building, the closing of the circuit being made by the standard clock at the observatory of Washington University, 700 miles away, to the exact fraction of a second in correctness. All the clocks in the building are kept uniform by the same signal.

Two of the States, viz., Florida and New Hampshire, present topographical models of their surfaces and shapes on a very large scale—perhaps fifteen by thirty feet—so that most of their physical features can be readily seen at a glance, while all of the States have most complete collections of their peculiar natural and artificial productions, artistically displayed.

The ethnological displays made by the Geological Bureau are most interesting, and include, as stated in the last issue of the REVIEW, products of aboriginal art, both ancient and modern, such as textile fabrics, pottery, implements of war, and the chase, and other curious objects connected with their religious ceremonies and festivities. The models of the Cliff-dwellings and of the pueblos of prehistoric and existing tribes from New Mexico, Colorado, and Arizona, are intensely interesting, and are constructed on a scale large enough to give a very fair idea of their architecture and other details. The Mound-builders, also, are fully represented by series of their implements, tools, ornaments, and other works, as well as by models of some of the most noted mounds and earth-works in the country. In fact, the $300,000 appropriated by Congress to enable the various departments of the Government to make fitting and useful exhibits at this Exposition, seem to have been most judiciously expended, and no one can fail to be gratified and satisfied with them, no matter in what subject illustrated he may be most interested.

Next month (February) doubtless everything will be in perfect order, so that then will be the most favorable time to come here, and the weather will probably be more propitious, for at present overcoat and fan are alternately and equally in demand.

C.

BOOK NOTICES.

THE BOOK OF ALGOONAH: Pages 353. Cyrus F. Newcomb & Co., Del Norte, Colorado, 1884. Cloth, $2.00.

This book is given to the public with a view of throwing light on a very interesting but obscure subject. The author admits that it will probably excite a great deal of honest criticism, but claims that it contains internal evidence of its authenticity as an historical book, and assures his readers that it is formed from authentic materials. It undertakes to point out the origin and career of the Mound-builders, designates "Algoonah, their first king, describes their formation as a nation, their home in the borders of Egypt, their travels through India, Tartary, and China to the Japan Islands, their exploration of Mezzinaroth (America), their settlement of Mexico and Central America, the history of this wonderful race and their landing on this continent, etc."

Being written in scriptural and allegorical style, it is difficult to follow the writer's idea at all times, but we recommend all archæologists to examine it with care.

CATARRH, SORE THROAT AND HOARSENESS: By J. M. W. Kitchen, M. D. Illustrated. 12mo, pp. 80. G. P. Putnam's Sons, New York, 1884. For sale by M. H. Dickinson, $1.00.

This little work comprises a description of the construction, action, and uses of the nasal passages and throat, certain diseases to which they are subject, and the best methods for their prevention and cure. Dr. Kitchen is the author of another work of a similar character, entitled "The Student's Manual of Diseases of the Nose and Throat," which has been highly commended, and he has filled and is now filling several positions in the New York hospitals and colleges, which eminently fit him to write from experience upon such subjects. The descriptions are accurate, and the suggestions for treatment sensible and based upon logical grounds and practical experience. Besides instructions for home treatment of these diseases, many of the latest instruments for professional treatment are described and illustrated, with hints and suggestions for physicians.

REPORT OF THE CHIEF SIGNAL OFFICER FOR 1883: General W. B. Hazen, U. S. Army, octavo, pp. 1164. Government Printing Office, 1884.

This ponderous volume contains the report proper of the Chief Signal Officer, which occupies but eighteen pages, and the appendix, charts, etc., which are the meteorological statistics gathered from stations all over the country, the reports upon the Lady Franklin Bay Expedition, and the Relief Expedition to Point

Barrow in 1883, outline of the lectures delivered to the Signal Service Corps of students at Fort Meyer, etc.

General Hazen deplores the reduction in the appropriation for weather observations as being detrimental to the interests of the people, alleging that the demands of the country upon the Signal Service are greater than ever before, and showing the value of the weather statistics and predictions by the verifications of the latter on sea and on land. The percentage of accuracy in predictions has increased from 84.4 per cent in 1882 to 88 per cent in 1883, and of course this accuracy will still increase with any increase of stations.

In fifty-four cities, meteorological committees, to act in concert with the Signal Service, have been appointed. The popular idea that the rainfall on the Western plains has increased with the increase of railway and telegraph lines, has been exploded by careful and special observations by skilled observers and plans for systematic collection of data concerning tornadoes have been made, which observations may be of service upon being classed and generalized.

Wisconsin Historical Collections. Vol. IX, 1880–81–82: Wisconsin Historical Society, Madison, Wis., 1883. Octavo, pp. 498.

The energetic and capable Secretary of the above-named society, Professor Lyman C. Draper, in collecting and editing this series, is doing an important and valuable work for the State. It consists of articles upon the archæology, the early history and the progress of Wisconsin, with biographical sketches of some of its best men, such as Governor E. B. Washburn, Col. Larrabee, Judge Barron, and others. It is just such work as every State should secure before it is too late, and one which will be more and more highly appreciated as time passes.

Progressive Morality: By Thomas Fowler, LL. D., F. S. A., President Corpus Christi College, Oxford Price, post-free, 15 cents. J. Fitzgerald, Publisher, 20 Lafayette Place, New York. For sale by M. H. Dickinson.

The progress of Natural Science has been not without effect upon the data of the moral and intellectual sciences. The present work, by an author of the highest eminence, is an attempt to show wherein the principles of moral conduct are reinforced or explained by the application to Ethics of the methods of research employed in the study of nature. The author aims to present a scientific conception of Morality in a popular form, and with a view to practical application rather than to discuss theoretical difficulties. His views are in full harmony with those which, making exception for a few back eddies in the stream of modern thought, are winning their way to general acceptance among the more instructed and reflective men of our day.

OTHER PUBLICATIONS RECEIVED.

Annual Report of Missouri River Commission for 1884, from Prof. G. C. Broadhead. Meteorology of the Mountains and Plains of North America, as affecting the cattle-growing industries of the United States, by Capt. Silas Bent. *Tidings from Nature*, January, 1885, Vol I, No. 5, Rutland, Vermont. Reports from Consuls of the United States on Commerce, Manufactures, etc., No. 47, October and November, 1884, Washington, D. C. John Hopkins' University Studies. Herbert Adams' Editor, 3d Series. Maryland's Influence on Land Cessions to the United States, by Herbert Adams, Baltimore, Md., January, 1885, 2d Series. Land Laws of Mining Districts, by Charles H. Shinn, A. B., December, 1884. *Humboldt Library, No. 63.* Progressive Morality. An Essay in Ethics, by Thomas Fowler, M. A., J. Fitzgerald, 20 Lafayette Place, N. Y., 15 cents. Signal Service Notes, No. 15: Danger Lines and River Floods of 1882, by H. A. Hazen, Washington, D. C. Circulars of Information of the Bureau of Education, No. 6, 1884, Washington, D. C. *Humboldt Library, No. 64.* The Distribution of Life, by Alfred R. Wallace and W. T. T. Dyer, 15 cents, J. Fitzgerald & Co., N. Y. The Line of Florida Railway and Navigation Company, Benjamin S. Henning, President, General offices Fernandina, Fla. Illinois Central World's Exposition, compiled by Miss Lydia Strawn. *Journal of Microscopy and Natural Science*, edited by Alfred Allen, January, 1885, Vol. IV, Part 13, 1 Cambridge Place, Bath, England. Proceedings of Boston Society of Natural History, Vol. XXII, Part 4, October, 1883, and December, 1883, Boston, Mass. *The Woman's Magazine*, Esther Housh, Editor, Frank E. Housh, publisher, Brattleboro, Vt., Vol. VIII, No. 5, January, 1885, monthly, 10 cents, $1 per annum.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

APPARATUS FOR LOADING CARS WITH COAL, ETC.—This invention has for its object the provision of improved means whereby box-cars and stock-cars may be readily loaded with coal or the like without the intervention of hand shoveling.

The apparatus consists principally in applying to the delivery or lower end of a coal chute a shunting-apron that is capable of being reversed or swung

around in a horizontal plane for the purpose of guiding the descending current of coal toward either end of the car, as may be desired.

The apron is constructed upon the plan of a quadrant, or quarter-circle, preferably of boiler-plate, and it is connected at or near its radius point to a rod extending laterally from the sides of the chute beneath the bottom thereof.

A hinge-piece is pivotally attached to the under side of the apron by means of a rivet or bolt.

The apron is provided upon its circumference with a raised flange corresponding in height to the chute side. This flange has upon its upper edge an aperture raised portion in order that a supporting chain may not come in contact with the chute sides. The upper end of the chain is attached centrally to a cross-bar of the supporting frame, and its lower extremity carries a hook which may engage any desired link of the chain for the purpose of adjusting the apron in relation to the chute bottom.

When the apron is in proper position the current of coal descending the chute will come in contact with the interposed flange and be thrown toward one end of the car, but when it is desired to fill the opposite end, a fastening bolt which passes through an aperture in the outer corners of the flange and through a corresponding aperture in the sides of the chute, is withdrawn, then the apron is swung around (the hinge sliding upon the rod) to a reverse position.

When the apron is not in use, it may be swung inwardly from either side toward the chute, entirely clear of passing cars.

The above described apparatus has been patented by Mr. A. Chadwick, of Kansas City.

PREHISTORIC STATUES.

An official communication received at the Navy Department announces the discovery on Rapanni, or Easter Island, on the charts in longitude 110° west and latitude 27° south, buried in the depths of the vast wilderness of waters of the South Pacific, of colossal statues and images rudely carved in stone. This remarkable find of archæological remains on a small island hundreds of miles away from any continent puzzles the learned scientists of the Smithsonian Institution and the National museum. Prof. Baird says on the subject: "In the present advanced state of ethnological science these monuments are of the highest importance. They will throw light on the somewhat mysterious manner in which this island receives its population."

The discoveries of these remarkable remains of a prehistoric and an advanced people in part of the world synonomous with cannibalism and savage life were the officers of the German gunboat Hyena, while on a trip from the Valparaiso to the Samoan Islands. The commander of this vessel, while thus cruising in the South Pacific, subsequently received orders from his government to visit Easter Island and secure these specimens. The accounts received by our government indicate

that the vessel remained at the island but a few days, but during that time the German officers made a considerable collection and copious notes. The results of their preliminary labors have been embraced in a pamphlet, which is reported at the Smithsonian Institution to contain a large amount of valuable information. The German government, it is understood, are making preparations to send an expedition to Easter Island with a corps of scientists and engineers to search the island, survey the ground, and to make plans and sections of the prehistoric buildings and ruins.

Our own government has also taken steps to secure some of these valuable remains for its large and valuable ethnological collection representing the prehistoric and known races of this hemisphere. Instructions have already been sent to Admiral Upshur, in command of the South Pacific squadron, to send one of his vessels on a cruise in the direction of Easter Island and to make such explorations, collections and reports as he may think important in the interests of the government. It is understood that the government of France is also turning its attention to this island with a view to the establishment of a protectorate.

It is reported in the accounts by the German vessel that the island, which is small, is strewn with large stone images and sculptured tablets. The Smithsonian has offered $1 each for prehistoric skulls with the lower jaw. The few people of Polynesian extraction who inhabited the island, know nothing about the sculptured remains found, and even tradition gives no account of a people living there when their ancestors arrived.

EDITORIAL NOTES.

PROF. RILEY, United States entomologist, has just received from George Cadell, Esq., Secretary of the International Forestry Exhibition at Edinburgh, the first gold medal awarded to him, it being the only gold medal awarded by the Exhibition managers to an American. The medal is large and handsome, with the words, "International Forestry Exhibition, Edinburgh, 1884." The reverse side has a wreath on a polished face with the words, "Awarded to Professor Riley, Washington, for Collection of Insects Injurious to Forest Trees."

MRS. JULIA SMITH, widow of the late Professor J. Lawrence Smith, of Louisville, Ky, has caused to be prepared for distribution among scientists and friends of the family, a very handsome memorial volume containing an account of his life, the honors conferred upon him in this and foreign countries, and a number of articles upon chemistry and mineralogy, written by him at different periods during his life. Professor Smith was a laborious investigator and an able writer, and the volume is a fitting tribute to his memory from one who knew him best.

WITH the mercury from 10° to 50° below zero in different portions of the country, earthquakes in Spain and elsewhere, avalanches in the Alps, universal snow storms and fierce winds, January, 1885, made a reputation for itself that will not soon be exceeded or forgotten. The 22d especially, was a notably cold day, the thermometer marking from 8° to 52° below zero in all the Northern States, from Kansas to New Hamp-

shire, while the cold was unprecedented in Arkansas, Louisiana, Texas, and other Southern States. Fifteen days steady sleighing in one month is an unusual record for Kansas City, while in the country adjacent it has been good for most of the time for nearly six weeks.

We call attention of our readers to the article of Professor Bassett upon the Crawfordsville (Indiana) crinoids as containing some facts not ordinarily known. He has been engaged for many years in studying these remarkable fossils under the most favorable circumstances, and for two or three years has made a business of supplying them to museums and public and private collections. Doubtless he is better acquainted with the subject than any man in the West. We have had the pleasure of seeing his best specimens and can testify to their beauty and perfection.

We are glad to be informed that the differences between the State Board of Health and the Hospital Medical College of this city have been adjusted, and that this institution is now placed upon the same footing as our other medical colleges, so that its graduates will hereafter be entitled to full recognition everywhere.

Professor S. H. Trowbridge, of Glasgow, Mo., writes thus pleasantly of the Review: "It is and has been from the start a grand success from a literary, educational, and scientific standpoint, and richly merits and should have equal success in a financial sense."

The time for applications for space in the International Inventors' Exhibition, to be opened in London, in March, has been extended to February 10. The Exhibition will continue for about six months, and will be presided over by the Prince of Wales.

Division 1. (Inventions) will be devoted to apparatus, appliances, processes, and products, invented or brought into use since 1862, and illustrations thereof.

Division 2. (Music) will consist of examples of musical instruments of a date not earlier than the commencement of the present century; and of historic collections of musical instruments and appliances, and paintings, engravings, and drawings representing musical subjects, without any restriction as to date.

Mr. Edgar C. Saunders, of Camp San Saba, Texas, sends us several nodules of sulphuret of iron which, he says, "lie upon a stratified formation of limestone and cover an area about three miles long by three-fourths wide." He notes their resemblance to meteorites and desires to know their origin, whether they have fallen out of the limestone in weathering, or whether they may be really meteorites.

We learn from Secretary E. E. Richardson's 14th Annual Report of the Kansas City Stock Yards that during the past year the total shipments were: 533,992 cattle, 1,724,287 hogs, 237,214 sheep, 27,092 horses and mules, and that for the fourteen years since the opening of the yards 12,427,422 head of stock have been received and shipped.

The Leavenworth Academy of Science at its last meeting elected the following officers for 1885: Hon. H. M. Aller, President; Prof. F. A. Fitzpatrick, Vice-President; Dr. R. J. Brown, Secretary, and Dr. T. Sinks, Treasurer. A resolution in favor of a State geological survey was passed and a committee appointed to present the matter to the Legislature this winter.

A committee of the National Academy of Science has replied to inquiries made by the joint committee of Congress on the proposed consolidation of the various scientific bureaus, by presenting a plan for the division of scientific work now performed into four bureaus, as follows: 1. The present coast and geodetic survey to continue. 2. The geological surveys as at present. 3. The meteorological bureau, to which should be

transferred so much of the present personnel and functions of the chief signal office as are not necessary to the military duties of that office. 4. A physical observatory to investigate the laws of solar and terrestrial radiation and their application to meteorology, with such other investigation in exact science as the government might assign to it

In this connection they suggest that the standard weights and measures be transferred to this bureau, and that the proposed electrical bureau be also included.

A bill has passed the House authorizing the building of a bridge across the Mississippi at Memphis. It is provided that two of the spans shall be not less than 550 feet in the clear; no span shall be less than 300 feet, and the height of the superstructure shall be 65 feet above extreme high water mark.

It is stated that extraordinary discoveries of silver have been made in the Cohuttah Mountains in Northern Georgia, by a Boston company. They claim to have traced a vein of 1,500 feet extending easterly through the mountain, a distance of eight or nine miles The assays run as high as eighty per cent.

The total enrollment of students at the University of Kansas for 1883–4 was 521, as against 582 for 1882–3. The apparent falling off is explained by the Regents in their report as having been caused by the discontinuance of the lowest preparatory class, which in 1882–3 numbered 125 members. They recommended an appropriation of $50,000 for the erection of a building for the Department of Natural History.

The State Historical Society met in annual session at Topeka, Kansas, January 20. Officers were elected for the ensuing year as follows:

President—D. R. Anthony, Leavenworth.

First Vice-President—B. F. Simpson, Paola.

Second Vice-President—S. N. Wood, Topeka.

Secretary—F. G. Adams, Topeka.

Treasurer—John Francis, Topeka.

The number of directors was increased from forty-eight to ninety-nine, and elected in classes for one, two, and three years.

The retiring president, Mr. F. P. Baker, and M. W. Reynolds delivered addresses.

At the annual meeting of the St. Louis Academy of Science, the following named gentlemen were elected officers for the present year: Prof. F. E. Nipher, President; Dr. Leete, First Vice-President; M. L. Gray, Second Vice-President; Dr. Evers, Corresponding Secretary; Prof. Engler, Recording Secretary; Dr. Sander, Treasurer; Prof. Hambach, Librarian. Mr. Alderdice, Dr. Luedeking and Prof. Hambach were elected Board of Curators.

A company known as the Natural Gas Company has been boring for some weeks at the foot of Third street, in West Kansas City, for gas, and recently struck it in considerable quantity. They claim a pressure of one hundred pounds to the square inch and a capacity of eighty thousand cubic feet per day, and announce their intention of immediately sinking two more wells. If their claims are well founded we may expect to see the manufacturing interests of Kansas City take an immense forward stride at once.

At a meeting of the Anthropological Society of Washington City the following officers were elected for the ensuing year: President, J. W. Powell; Vice-Presidents, Dr. Robert Fletcher, Prof. L. F. Ward, Col. Garrick Mallery, Prof. O. T. Mason; Secretaries, S. V. Proudfit, F. A. Seely; Treasurer, Prof. J. H. Gore; Curator, W. J. Hoffman; Members of Council, H. H. Bates, Dr. Frank Baker, Rev. J. O. Dorsey, W. H. Holmes, David Hutchinson, Prof. Cyrus Thomas.

ITEMS FROM PERIOICALS.

Subscribers to the Review *can be furnished through this office with all the best magazines of this Country and Europe, at a discount of from* 15 *to* 20 *per cent off the retail price.*

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WHETHER we agree with Mr. Beecher or not, few men can speak or write on any subject of public interest with so great a certainty that everybody will want to know what they say. In discussing the question as to how far ministers may properly go in politics—which he does in the *North American Review* for February—the great preacher shows himself to advantage perhaps all the more because it is a matter that touches him personally as well as professionally. In the same number of the *Review*, the question, "How shall the President be Elected?" is ably treated by five happily chosen writers, viz., two United States Senators, Dawes and Vance; a college president, F. A. P. Barnard, of Columbia; a New York lawyer, Roger A. Pryor, and a well-known journalist, William Purcell. The substantial agreement of four of them on the same point is significant. Another notable article in this unusually strong number is a review of "Holmes's Life of Emerson," by the veteran historian, Geo. Bancroft; and still another is an essay by Prof. C. A. Young on "Theories regarding the Sun's Corona," which he skillfully brings within popular comprehension. The Rev. Dr. W. G. T. Shedd defends the dogma "Endless Punishment," and Prof. G. Stanley Hall writes on "New Departures in Education."

WE suppose that we are in debt to Mr. William Hosea Ballou, of New York, for the following flattering notice in the *Saturday Evening Herald* of Chicago: "The KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY is perhaps the only successful monthly west of New York. When literary monthlies find an uncongenial soil in the West, it is all the more remarkable that a high-toned periodical, devoted exclusively to science and requiring seventy 8vo pages for each issue, should grow and thrive. THE REVIEW is almost in its ninth volume. Its contributors are mainly Western men who have conferred a lustre on the unlimited scientific research of the vast prairies and vaster mountain ranges. This successful exponent of class journalism is entirely the work of its able editor, Mr. Theodore S. Case."

WE find in the Boston *Literary World* the following appreciative notice of a new book compiled and arranged by Messrs. Fulton & Trueblood of this city: "The distinctive features of Fulton & Trueblood's volume of selections for readings, 'Choice Readings from Standard and Popular Authors,' are the abundance, variety, and excellence of the selections themselves, the prefixed diagram of the elements of vocal expression, showing the different kinds of thought embodied therein, the representation of the seven great orators of the world, the scenes from popular dramas, and the appended descriptive indices to selections from Shakespeare, the Bible, and Christian hymnology, suitable for public use. The collection is unusually rich, dignified, and suggestive."

WE have received the first number of the *Journal of Mycology*, published at Manhattan, Kas., and edited by Prof. W. A. Kellerman of the Kansas Agricultural College, assisted by J. B. Ellis of Newfield, N. J., and E. M. Everhart, of Westchester, Pa.

It is a neat little magazine of sixteen pages, and will be devoted to mycological botany, special attention being given to the North American fungi. It will aim to be the organ of students of this branch of botanical science, and as such deserves the patronage of all persons interested in it. Monthly, $1 00 per annum.

DURING 1885, subscribers to the *Art Interchange* will receive thirteen (13) full-page colored supplements, some double size; twenty-six (26) extra pattern supplements, containing over one hundred full-size outline artistic designs, ready for tracing, applicable to all the varied branches of art work.

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It is always a pleasure to receive the *Atlantic Monthly*. The February number is especially interesting. We give its contents herewith: A Marsh Island, IV–VII., Sarah Orne Jewett. Winter Birds about Boston, Bradford Torrey. Spirit of Spirit, Edith M. Thomas. Madame Mohl, her Salon and Her Friends; second paper, Kathleen O'Meara. A Sheaf of Sonnets, I Ellen Terry's Beatrice; II The Resolve; III On First Reading Landor's Hellenics; IV Bach's St. Matthew Passion Music; V The Passing of the Year, Helen Gray Cone. The Prophet of the Great Smoky Mountains, II., III, Chas. Egbert Craddock. The Quest for the Gral of Ancient Art, William Shields Liscomb. Vernon Lee, Harriet Waters Preston. A Country Gentleman, IV–VII M. O. W. Oliphant. The New Portfolio, II Oliver Wendell Holmes. Strange, E. R. Sill. Nathaniel Hawthorne and his Wife. Mr. Parkman's Montcalm and Wolfe. Johnson's Persia. A Word for Pepys. The Contributors' Club. Books of the Month.

In the *Popular Science Monthly* for February, which was received rather more promptly than usual, we find the following articles principally written especially for its columns: The Sight and Hearing of Railway Employes, by William Thomson, M. D. (Illustrated); Calculating Machines, by M. Edouard Lucas, (Illustrated); The Larger Import of Scientific Education, by J. W. Powell; Evolution and the Destiny of Man, by W. D. Le Sueur; Food and Feeding, by Grant Allen; Sulphur and its Extraction, by C. G. Warnford Lock, (Illustrated); Physical Training of Girls, by Lucy M. Hall, M. D.; Field Experiments in Agriculture, by Prof. H. P. Armsby; Cholera, I, Its Home and Its Travels, by Dr. Max von Pettenkofer; The Chemistry of Cookery, by W. Mattieu Williams; Sick-Rates and Death-Rates, by Cl. T. Campbell, M. D.; Properties and Constitution of Sea-Water, by M. Antoine de Saporta; Why Birds Sing, by Dr. B. Placzek; Sketch of Sir David Brewster, (With Portrait); Correspondence; Editor's Table: "Mind as a Social Factor"—The Relation of Science to Culture; Literary Notices; Popular Miscellany; Notes.

The Scientific Club of the Kansas Agricultural College meets monthly in the Chemical Laberatory. Professor W. A. Kellerman is President and Professor I. D. Graham Secretary. Among its other active members are Prof. Failyer, Prof. Popenoe, Prof. Shelton, Mr. M. A. Carleton, Mr. Lund, A. W. Jones, J. B. Brown, Warren Knauss, and others. From its proceedings, as published in the *Industrialist*, it is evident that this club is doing a good work for the Institution and the State.

Professor B. Silliman, one of the editors of the *American Journal of Science*, and son of its originator, died Jauuary 4, after a long and useful career as editor, professor of chemistry in Yale College, author of several text books on chemistry and natural philosophy, charter member of the National Academy of Sciences, honorary member of the principal scientific societies of Europe, etc. He was 68 years of age and was apparently still in the prime of life when he was taken away. His loss will be severely felt among scientists all over the world.

Science, now in its third volume, has had a very successful career so far, and has made a decided impression upon the scientific world as an innovator, at least in manner. It has been ably supported and has presented the new theories and discoveries of the past two years promptly and authoritatively. It is now so firmly established that it can can hardly fail to hold a leading position among the scientific periodicals of the day, either in this country or on the continent. Being, strictly speaking, the only weekly scientific journal in the country, it deserves the patronage of all readers who desire or need to keep fully up with the rapid progress of the age in science.

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TABLE OF CONTENTS.

PAGE.

MEDICINE AND HYGIENE.
1. Sanitary Plumbing.* John Fee, M. D. 605

GEOLOGY.
1. Description of Marble Cave, Mo . . 614
2. A Natural Curiosity in California. . 623
3. Rambles of a Naturalist About Kansas City.* W. H. R. Lykins 650
4. The Tertiary of Harper County, Kansas.* Prof. F. W. Cragin 652

ENGINEERING.
1. The Nicaraguan Canal. Admiral Daniel Ammen 623

METEOROLOGY.
1. Meteorology of the Mountains and Plains of North America. Captain Silas Bent 626
2. Kansas Weather Service.* Prof. J. T. Lovewell 631
3. Thermometers.* 632

BIOGRAPHY.
1. Sketch of Life of Prof. B. Silliman.* Prof. H. E. Sadler 636

ARCHÆOLOGY.
1. "Did the Romans Colonize America?"* C. W. Irish 640
2. Cave and Cliff-Dwellings of Arizona. Rev. Isaac T. Goodnow. 647

EDUCATION.
1. Difficulties in Searching for Truth.* Prof. S. H. Trowbridge 655

PAGE.

ASTRONOMY.
1. Sun and Planets for March, 1885.* Wm. Dawson 652
2. The Eclipse of the Sun of March, 16th.* Prof. W. W. Alexander . . 653

BOOK NOTICES.*
1. Original Researches in Mineralogy and Chemistry, by Dr. J. Lawrence Smith 659
2. Geological Excursions, or the Rudiments of Geology for Young Readers. S. C. Griggs & Co 660
3. Conditions of Mental Development, Etc. J. Fitzgerald & Co . . 661
4. School-keeping: How to do It. New England Pulishing Co 661
5. Systematic Mineral Record. A. S. Barnes & Co 662
6. Rural Taste. Herald Printing House. 662
7. Other Publications Received 663

SCIENTIFIC MISCELLANY.
1. Recently Patented Improvements.* J. C. Higdon, M. E 664
2. Kansas Cane and Sugar Association.* Prof. E. H. S. Bailey 666

EDITORIAL NOTES 667

ITEMS FROM PERIODICALS 668

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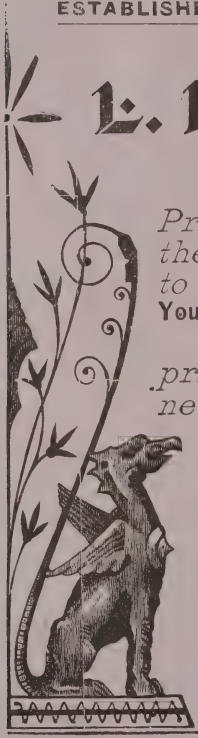
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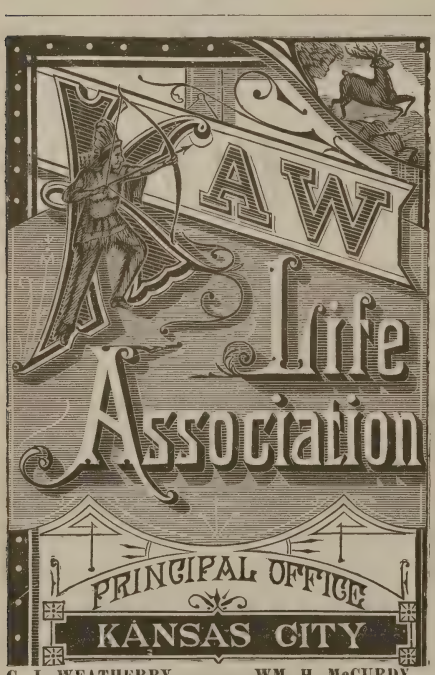
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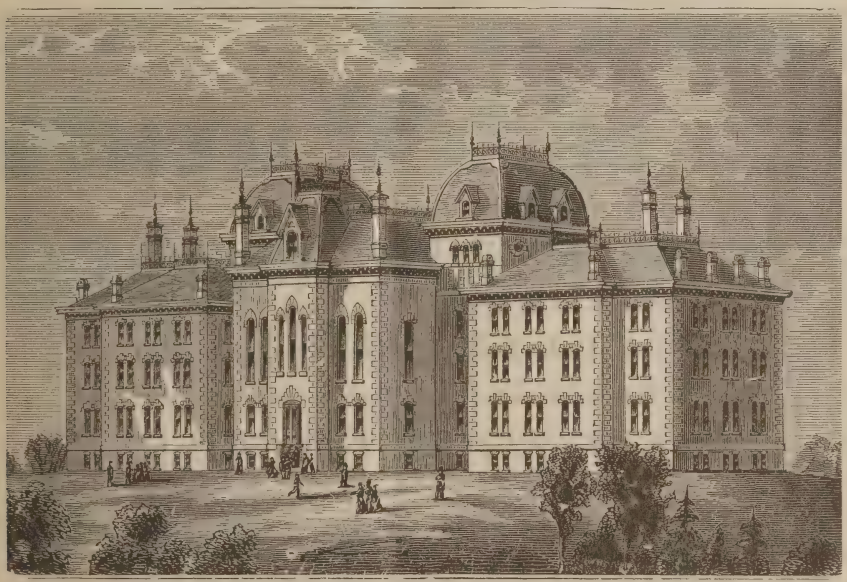
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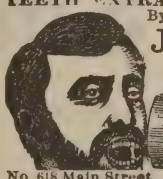
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KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. VIII. MARCH, 1885. NO. 11.

MEDICINE AND HYGIENE.

SANITARY PLUMBING.[1]

JOHN FEE, M. D.

I feel highly honored and gratified with your invitation to address you this evening. It gives me pleasure to meet this Society, composed of gentlemen engaged in the same work, that of practical sanitation, which has occupied my time and labor during the past four years.

I feel gratified with the privilege of meeting you here because I know we can enlighten the people of this city in regard to proper plumbing and house drainage, and place one branch of the art of practical sanitation in such prominence before the public that its untold benefits may be properly understood and appreciated.

We have reached the time in this city when the public must be instructed in regard to one of the most indispensable arts known to man; an art which, more than any other, perhaps, makes the possibility of a great city, and without which mankind would spread out over the country and harmonize with the teachings of Mr. Ruskin.

The intelligent plumber is a practical sanitarian, and his work properly done gives cleanliness, comfort and health. The work of the ignorant and unscrupulous plumber, however, brings expense, discomfort and disease.

1 Delivered before the Master Plumbers' Association of Kansas City, February 10, 1885.

This city is in a transitional stage; it is passing from the town into a city, which if judiciously governed and instructed will, in a short time, become a great metropolis.

To the people of this city then, the study of sanitary regulations has become a necessity. It has been my fortune to investigate, to some extent, the chief great lines of human thought, theology, jurisprudence and science; and during the past four years my study has been exclusively devoted to sanitation, or to the protection of the public health, and I have no hesitation in saying that this latter science is the most essential field for human study and investigation, and offers to society the most practical results and the greatest benefits.

To the student of history there is a great fascination in the study of the moral, social and intellectual development of our ancestors; and no man living amidst railways, telegraphs, and comfortably constructed dwellings can go back to the days of the earliest history of our Indo-Germanic ancestors, when they were but little more than savages, and then trace their development; first, their wrestle with religion; next, their struggle for personal and political liberty, and subsequently their invention of the practical arts and sciences without mingled feelings of pride, wonder and reverence.

In surveying the results of the intellectual development of our race, we must be struck with two facts, namely: The centralization of mankind in great cities, and their increased attachment to this earthly existence. The massing of human beings in great centers seems to be the unavoidable result of our material and social development. These cities are manufactories of all those articles which we consider necessary to our comfort. These are also the centers of thought and of intellectual production and mental commerce, which, in the present brain development of our race are as essential to our happiness as are our material inventions.

The increased attachment of mankind to this earthly home as a result of our modern civilization, is equally apparent. In making this statement, I would not underrate popular faith in a future existence. No doubt this quality of mind is as general now as it has been at any time past in the history of the race, but such are the comforts, material and intellectual, which environ our present existence, that the majority of mankind prefer to bear the pleasures and enjoyments which they have, than to flee to those they know not of. There is nothing strange in this worldly attachment; it would be unaccountable were it otherwise. When we consider the advantages which surround our existence, compared to the meagre pleasures and conveniences of our ancestors, our homes seem like dream-lands, and our material and intellectual advantages like hallucinations or flights of imagination. Let us for a moment survey some of our advantages.

First, we may remark that the invention and use of the sewing machine, electric light, telephone and telegraph are within our own recollection. To some of us this is true in regard to the invention of and use of the railroad, steamboat, and steamship. The use and application of light within our recollection has almost revolutionized our social organization. For all purposes of business or

pleasure, we have made the night almost as subservient as the day. On the contrary, how gloomy must have been the long winter nights of our ancestors without illuminated streets, and with houses dimly lighted with rude lamps?

Gas for illuminating streets was first used in London in 1816. The candle is a comparatively modern invention. The so-called candles alluded to by the ancients and in the Scriptures, are believed to have been rude lamps for the burning of olive oil, and these were continued down to the end of the eighteenth century. The first improvement in wicks took place in France in 1783.

The use of spectacles did not become general until after 1313, when they were invented by an Italian monk. This universal boon to mankind ought to be considered a very considerable set off against relic worship and asceticism.

Think of one reaching forty-five years of age and then the print of the newspaper growing dim, week by week, until at fifty one is shut off from the news forever. Again, the first weekly newspaper was not printed until 1615, when it was issued in Frankfort-on-the-Main; but the real newspaper, the morning daily, with its fresh news from all parts of the world, is a work that has been perfected and brought into successful operation within the period of our own memories.

But again, nowhere do the advantages of our modern civilization and the disadvantages of our ancestors stand out so conspicuously as in the comparison of habitations. Chimneys were unknown before the fourteenth century, and did not come into general use for a long time afterward. It is even said that the ancients had no knowledge of chimneys. We have only to contemplate our comfortable rooms, heated with stoves or hot air furnaces, or with steam, and then to view our ancestors hovering over a few coals in a dim, smoky room, with no place for the escape of smoke and the poisonous products of combustion, except a hole in the roof, to appreciate our inestimable advantages. Window-glass, also, did not come into use before the fifteenth century. Paving the streets was unknown to our ancestors until 1184, when it was first tried in Paris. It seems to have been an invention which made but little impression on the people, as it was not introduced into London until 1533. Sewers were unknown to our progenitors until the beginning of the thirteenth century and were then only used for the removal of storm-water. Until a comparatively recent period, the discharge of sewage proper into the sewers was prohibited by law in London. The use of sewers for the removal of house waste is an invention of the present century.

But I will not dwell longer on the enumeration of those inventions which are calculated to give a charm and to impart an attachment to this existence unknown to our forefathers.

Although we have elaborated the fact that the tendency of our modern civilization is to the congregating of mankind in great cities, and have pointed out the many gains which we possess over our ancestors, we have yet to mention the additional fact that all these benefits have been obtained by many sacrifices, and that there are innumerable dangers inseparable from our present social organization. These dangers are such as affect the public health. The very flocking

together of human beings into great cities brings numerous diseases, both to infantile and adult life. In fact, these maladies, such as diphtheria, measles, scarlet-fever and small-pox, have threatened at times to destroy great municipalities.

The overheating in the summer season and the ill-ventilation of residences decimate cities of their infantile population. Commerce, too, is a constant menace to mankind, because it brings not only an interchange of products, but also an exchange of diseases.

The ships which come from the Ganges and the Nile to the occident, laden with their rich cargoes, bring with them pestilential cholera; and vessels which sail from tropical ports laden with coffee, sugars, and fruits, bring with them the seeds of tropical fevers; and thus there is a bitter for every sweet, and an enemy skulking in ambush for every friend. It is the mission of sanitary science to give success and permanancy to our modern civilization in every land and in every clime; in a word, to protect the growth and insure the success of great cities. This has been effected for many great cities. The city of London, for example, contains a population equal to that of New York, Paris, and Berlin put together, and yet has a lower death rate than either one of these cities. Sanitary science constitutes a broad and inexhaustible field for human investigation.

It includes a large scope for jurisprudence for law making, international, national, state and municipal. In some countries, sanitary legislation has received a study equal to its importance, and in some parts of the United States, particularly in the State of Massachusetts, it has become an elaborate and useful code, both State and municipal. Practical sanitary science includes the profession of the architect as to heating and ventilation, the sanitary engineer or sewer builder, the plumber, and the chemist, who devotes himself to the study of foods and the prevention of the crime of food adulteration. Here let me digress for a moment and point out the fact that the adulteration of foods is the greatest and besetting crime of the age, and of this country and of this State in particular—that substance only, which is not adulterated, is that article which is cheaper than any adulterant.

Coffee, tea, sugar, molasses, candies, honey, butter, lard, oil, liquors of every description, drugs of every kind, all are adulterated, and no legislature, no State board of health brings the miscreants to justice. Again, sanitary science includes the physician who studies the nature and history of pestilential diseases and their prevention. It includes the labor of the practical health officer, who enforces proper regulations for municipal cleanliness; for sanitary science, when reduced to first principles, to its quintessence, is cleanliness. The architect's endeavor to secure proper ventilation of the home is but an effort at cleanliness. The sewer is an adjunct for cleanliness, and the pipes for house drainage and water-service put in by the plumber are means for reaching the same end.

Sanitary science is the enemy, the antipode, of Malthusianism. It endeavors to prolong life, to save life, to fight off death. It teaches that society has an interest in the preservation of every human life, a social, a moneyed, a material interest in the protection and prolongation of every human existence. It assumes

that the child must live for the parent, that the investment of money, love and affection by the parent must be reimbursed and returned by the offspring. It has no fear of the over-production of the human race, and no alarm lest the food supply of mankind will leave them without subsistence. Although I believe that the teachings of Malthus are false and untenable in theory, yet it is a fact that they have been verified in many countries. In many of the capitals of Europe, and in some of the cities of this country, the annual death rate has equaled and in some years more than equaled the birth rate, so that were it not for the constant recruiting of population from the rural districts, the population of these cities would diminish or even become extinct. Some of these cities, however, with the highest and most abnormal death rate, have grown with unparalleled vigor and rapidity, owing exclusively to the influx of population from the country districts.

This destruction of human life in great municipalities, however, has no necessity. It has no compensating advantages to the race; it is not, to any great extent, in obedience to the law of food supply, but is purely the result of human ignorance and indifference to those conditions of health which surround us. It is the result of defective sewerage, ignorant plumbing, ill-ventilation, the overcrowding of tenement houses, and the non-observance of cleanliness, all of which evils characterize all great municipalities. With these general remarks, let us consider particularly the business or profession of the practical plumber.

The plumber is a practical sanitarian and is, perhaps, the oldest worker in the art of protecting the public health. His art reaches far back to the first pages of history. He was known to Jerusalem in the days of the magnificence of Solomon, to Babylon when she was the seat of empire, and to Athens and Rome as they successively triumphed as the controlling powers of the Orient. Wherever the genius of man founded great cities, the homes of wealth and splendor, and the centers of political influence and power, there the cunning of the plumber was invoked to bring pure water from the rivers and lead and control it within the habitations of man, and to give comfort and health to palaces and luxury to the king and his court. In modern times the plumber has figured more conspicuously. His art has been used not alone for bringing limpid streams into palaces for the gratification of courtiers and kings, but it has brought the luxury of pure, wholesome water into the habitations of the poor, into the workshop and manufactory, and has made it subservient to numberless uses unknown to the ancient world, such as for heating purposes and for driving machinery, and thereby relieving man of much drudgery. We are, therefore, principally interested in the plumber of the present day. On this point we may remark, that plumbing is a progressive art, and has undergone many improvements within a comparatively recent period. The practical inquiry then presents itself—what is the state of the art in this city? Has the work performed here been done in the best style of the art? Before answering this question I will say that I have every reason to believe that the gentlemen before me are as well versed in the theory and art of their profession as any equal number of plumbers in any other city of this coun-

try. In answer, however, to my inquiries I think the majority of you will agree with me in saying that the plumbing which has been done in this city has, in the greater part of it, been done in a very unsatisfactory manner. Of course some exceptionally good jobs of plumbing have been made, but as a rule the plumbing work is not up to the latest demands of the art. This is not only true of this city, but it is true of every city where there are no plumbing laws and no inspection of the plumber's work. The condition of plumbing in this city could not possibly be worse than it was a few years ago in Boston, New York, Brooklyn, Washington and Chicago, before their plumbing code came into existence. Let us inquire what are the causes of inferior and dangerous plumbing. First, property owners are largely responsible for cheap plumbing. Many of them have very crude ideas of plumbing and care less to learn anything about it, and know nothing about the dangers of drainage gas. They are eager to drive a smart contract with the plumber, just as they would bargain for the excavation of the foundation by the cubic yard, or for the brick by the thousand, so that they often get cheap plumbing, with typhoid fever and diphtheria thrown in for nothing. The avarice of property owners and their indifference to healthy plumbing is one of the almost insurmountable obstacles to correct plumbing. But again, the indifference and ignorance of some architects as to correct plumbing is another difficulty to be overcome. We have in this city as intelligent a body of architects as can be found elsewhere, but, gentlemen, I impart no secret to you when I tell you that there are architects in this city who cannot write out correct and proper specifications for a complete system of house drainage. Now, we all know that in order to put in a perfect system of house drainage it should be properly provided for by the architect, from foundation to roof, and that if the architect does not do his work properly the plumber cannot perform his.

In this work of correct plumbing the architect has the greatest responsibility, for however avaricious the builder may be, he generally puts great confidence in his architect, and imagines that what the architect does not know is not worth finding out. It is the solemn duty of every architect practicing his art in a great city to make an exhaustive study of plumbing and not to be satisfied with a superficial knowledge of this subject, gleaned from some occasional article found in an architect's journal, or from some specifications of a plumbing contract observed in some book of contract forms, or obtained from the pictures of plumbing fixtures found in some advertising manual which has come gratuitously into his hands from some wholesale manufacturer. It is not enough for the architect to know that the foundation of the house is all right, that the walls will not crack, that the roof will not fall in, that no ordinary wind storm will blow it down, or that no common tramp can raise the window or pick the front door lock ; it is his business to know that he has not written up and perfected plans and specifications for a nest of typhoid fever and diphtheria. But plumbers, gentlemen, have their responsibility in this matter. Have you, as a body, banded together and endeavored to enlighten the community as to the importance of correct

plumbing, and as to the dangers of cheap and imperfect drainage? And have you superintended all your work punctiliously? Have you scrutinized every joint, every gasket, every pipe, as to weight and freedom from imperfect casting? Were there no flaws in the drain pipe, was it properly glazed and laid at a proper inclination? These are questions for you to answer in your moments of self-interrogation. It is only a few weeks since, that a plumber was arrested and punished in New York for carrying through the roof of a house, a phantom or dummy soil pipe. I suspect, notwithstanding the heartless motives unjustly imputed to the plumber, that there are times in his history, when he takes up the morning paper and reads the death notice of some child, that has been removed by diphtheria, in which a feeling of chagrin and remorse steals over him. But again, the city government, the health department, and the sanitary superintendent are responsible for this lack of correct plumbing; for it is a fact, that good plumbing is not general in any city unless regulated and obtained by law.

As long as street cleaning or the removing of garbage is not regulated by law, so long will the city be filthy. So long as every man is let to adulterate food, so long will the common necessities of life be debased by heartless men, and so long as the building of a system of house drainage, in any building, public or private, is left to the avarice or ignorance of any man, so long will that art jeopardize the safety and welfare of the community. As before remarked, I suppose that some of the plumbing work in this city has been faultless, both in theory and construction, but it has not fallen to my lot to see any of this work. I have, however, been credibly informed of its construction. I have, on the contrary, seen numerous instances of incorrect plumbing. I have seen soil pipes without fresh air inlets, and terminating on the same floor as the fixtures, or on the first or second floor, without going up through the roof. I have seen a soil pipe in a residence end in the chimney. I have known it to terminate in the smoke-stack of a public building, either to be filled up with soot or, under some circumstances, to be so affected by the draft as to unseal the traps. As a rule, I believe that the danger of the siphonage of traps has been wholly overlooked and ignored in this city. I have never seen a common "S," or siphon trap, ventilated in this city, yet I know that there is not a city, where there is a plumbing law, that would allow an "S" trap without a vent pipe to be connected with any fixture of a soil pipe.

Now, gentlemen, I think you will agree with me when I say that we need a reformation in the plumbing work of this city. That reformation should begin first with the work of putting in the water service. There is nothing so essential to the public health and comfort as the general use of the water service. We need in this city to get our water supply from above Argentine, or preferably above Wyandotte, and then we shall abandon all cisterns and wells. In fact, no well should now be allowed by law within the city limits. Water then should be introduced from the public supply into every tenement and lodging house and into every habitation in the city. But the water service pipe must be put in differently from the work done heretofore. This freezing of the water pipe or shut

ting off water from the household during two months every winter must be stopped. It is the business of the plumber to put in the pipe so that it will not freeze, to jacket it with resin or plaster-of-Paris, or with some other non-conducting material, so that it will not freeze up. There is nothing that brings your art into such disrepute as the yearly freezing of the water service pipe, and the little money you make by repairs of frozen pipes is more than ten-fold counter-balanced by the fears and prejudices of house-holders against plumbing on account of this annual bursting of pipes and the expenses and damage incurred thereby. No plumber should ever put in any water pipes which he knows will freeze up, without a decided and vigorous protest. With regard to drainage pipes all should demand that the work and material be equal to the most advanced knowledge of this service. To affect this purpose the work will have to be inspected by a practical plumber acting under municipal authority, and municipal authority will have to be secured through the members of the city council. Here you may meet with difficulty, but perhaps not with as much as you may expect. I believe that Kansas City to-day is ahead and in the lead of all the cities of the State in sanitary matters and that the public sentiment here is more progressive than elsewhere within the State.

The greatest drawback in this city is want of money. We need money for a city hall, for a hospital, some people think for a market house, and for grading and sewering the city, so that our legislators are apt to think we have none to spare to pay more city officials. It seems to me, however, that the inspection of plumbing is too important a matter to be delayed on account of the demands on the treasury, and that the expenditures of the city, in other directions, should be so curtailed as to leave a fund for the inspection of plumbing. Within the last ten days numerous complaints have been made to me of sickness induced by drainage or soil-pipe gas. I have been so busy that I could not inspect the localities reported, but I fear that on inspection the complaints will be found to be true.

Again, if the inspection of plumbing is delayed for a number of years it will be a very difficult matter to remedy defects, and property owners will be indignant at the great amount of work to be torn out of their buildings. In a matter of such vital interest to the public health, the expense of a plumbing inspector ought not to form any valid objection, and I believe will not when the facts are properly presented to the city council in regard to the legislation which you require. I hope, gentlemen, that before another year your influence will be felt throughout the country. Other associations within the same time have achieved a national influence and reputation. The master plumbers of Chicago, for example, illustrate the truth of my statement, as shown by the following extract from a lecture recently delivered at Hershy Hall by Dr. O. C. DeWolf, health commissioner of that city. The doctor says:

"One year since you did me the honor to invite me to address you on such a subject as would mutually interest us as sanitarians, and, on that occasion, I met, for the first time, a body of artisans of whom I had known much and seen

little. I ventured to suggest to you the importance of intelligent organization, and pointed out to you some of the results to your guild which might be expected to follow such united and harmonious action. I am surprised at the work you have accomplished. I have seen the president, recording secretary, financial secretary and a majority of the executive committee of the National Association taken from your ranks, and to-night you stand among your fellow craftsmen the most influential body of plumbers in the United States. This statement will not be denied by any one who has followed the professional literature of your guild for the past few months. I congratulate you and rejoice with you. As a preface to what I have to say to you to-night, I wish again to emphasize the importance to yourselves of a wise, broad, intelligent, active and generous spirit of association, both for personal benefit and that the influence of your organization may be as far-reaching and potential as you desire."

Here, gentlemen, I should, perhaps, stop, but I cannot refrain from making some suggestions to you in regard to your avocation and its relation to your pecuniary, social, intellectual and political influence. Your vocation is a peculiar one. It is not a business which simply requires labor, even skilled labor, but it is both an art and a science. The man who can wipe a joint perfectly, who knows the mechanism of a flush-tank, or of a system of house drainage or of steam fittings, is not, therefore, a perfect plumber. He must not stop with the mechanism of the business, but he ought to know much of its theory and of the chemistry and science of the materials with which he labors. The plumber ought then to be more than a laborer; he should be a skilled and scientific artisan. I take it for granted that the object of your association is personal improvement, intellectual, social and pecuniary. What then will contribute to your success? I answer, to raise the standard of intelligence, of professional skill and social worth high in your association. Make the admission into your guild as difficult and not as easy as possible. Lengthen out the period of apprenticeship. I do not know how long it is, but it should in my opinion be not less than five years. In addition to this, you should require of your apprentices a regular course of study and annual examinations, which could be made before a board of examiners appointed from your association. To my mind, a programme of examinations like the following might be adopted: At the end of the first year, examination in arithmetic and book-keeping; second year, algebra and elements of drawing; third year, algebra continued and mechanical drawing; fourth year, elementary chemistry and hydraulics; fifth year, hydraulics continued and the special chemistry of water and of the metals. These studies could be pursued during the long winter evenings and would take the young apprentice away from the evil allurements of city life and would force him to spend his otherwise leisure hours in a school for mathematical instruction and in the laboratory of the practical chemist, and would cause him to become a thoughtful, well-rounded man, and an influential citizen.

Nothing lowers and debases a business or avocation so quickly and surely as easy and cheap access to it. All the evils of low wages, scamped or inferior

workmanship, of unfair and dishonorable competition, of jealousies and of professional envy and backbiting, can be traced directly to short and hurried apprenticeship. A business or profession which shortens its course of study of apprenticeships, which eagerly seeks every youth for its pupil, and opens wide its portals of instruction, offering every inducement which appeals to indigence, ignorance and to mental inactivity and stupidity, is not worth having, and is alike disgraceful and dishonorable to the recipient and to the donor. Again, gentlemen, I say, make your standard high, access to your ranks difficult, the period of apprenticeship and of instruction long and exacting, and do not fall in with the popular idea of license instead of liberty, which accords to any man the right to follow any profession or carry on any business, however intimately or delicately associated with the public welfare, without a previous training and instruction for intelligently and skillfully discharging its obligations. Permit me to say, in conclusion, that for reasons which are now manifest, I ought not, perhaps, have acceded to your invitation to address you. My official duties during the past four years have been so numerous and exacting that I have had no time for literary composition and for preparing a lecture, such as would do justice to you or myself. But I could not resist the opportunity of co-operating with you in your first efforts in this city. And, gentlemen, whatever shall be my future in this city, in office or out, you may always consider me at your side, battling with you for your rights as sanitarians and as public benefactors.

GEOLOGY.

DESCRIPTION OF MARBLE CAVE, MISSOURI.

FURNISHED BY CAPT. J. B. EMERY.

Roark Mountain, in Stone county, Missouri, is the highest point of the Ozark range within a radius of twenty-five miles. It is surrounded by the head waters of Roark Creek, Big and Little Indian Creeks, Fall Creek, and Jacob's Branch, all flowing in different directions. To the south is White River, towards which the mountain slopes; to the north James River. The first is about three, the other six miles from the top of the mountain.

That top is a strip of table land, about one mile long and from an eighth to a quarter of a mile in width; one thousand feet above the level of White River. A magnificent view presents itself from that point. The eye sweeps over range after range of mountains, heavily timbered with oak, black-walnut, cedar and pine, valleys with streams meandering through them. A bracing, invigorating atmosphere. Abundance of game. Springs of pure water, and medicinal springs,

chalybeate, sulphur, etc. Almost every variety of ordinary fruit finds the soil and climate congenial.

Nearly in the middle of the level space on the top of Roark Mountain is a depression, an oval shaped sink, two hundred and fifty feet long and eighty feet at its greatest width. This sink is the mouth of a funnel, standing perpendicular above the mouth of a gigantic cave, called Marble Cave, after the rock by which it is walled in. The mouth of the cave is in the middle of its roof.

The sides of the funnel taper downward, rather steeply, till a depth of one hundred feet is reached. Not so steeply, however, but that one can climb down them along a rugged path. These sides are of huge blocks of flint-rock with earth between, sufficient to afford, at intervals, footing for trees one foot and a half in diameter.

After having gone down the side of the funnel-shaped sink, one comes to another opening nearly oval, thirty feet long and from five to fifteen feet in width, the bottom of the funnel. This opening is at two places bridged over by large rocks, which have fallen down and become wedged in. It really is a hole in the top of the roof of the cave, which roof here is from fifteen to twenty-five feet thick. Now the rock is grey marble. Below one of the wedged-in rocks, a ledge projects, jotting out from the side of the hole in the roof of the cave. A path leads to that ledge. From the ledge one descends by means of a ladder, sixty-five feet long, to the top of a pile of rock, earth and rubbish, rising upward in the shape of an irregular truncated cone, from about the middle of the floor of the cave. That pile is about two hundred feet high. A rough, winding path along its side leads to the floor of the cave.

The cave is nearly circular, in the shape of an inverted bowl, flattened at the top. That flat top is of dove-colored marble and two hundred feet in diameter. The floor of the cave is seven hundred feet in diameter. The roof is about two hundred and fifty feet high. The sides along the bottom are of granite. Above that comes a layer of onyx, mostly white and sixty feet thick; above that thick layers of dove-colored, variegated, brown, red and drab marble, mostly dove-colored; and between the layers of marble are thin layers of flint rock. Between the layers of marble in the sides and the flat marble top of the roof is limestone.

The base of the cone-shaped pile in the cave is from two hundred to four hundred feet in diameter. It comes at one place within a short distance from the wall of the cave and at another leaves a space of nearly five hundred feet. It seems to have been caused by a volcanic upheaval and increased by earth and debris falling down through the opening above. At noon the vertical rays of the sun strike the top, rendering the strata in the roof dimly visible, and more clearly outlining the upper part of the cone-shaped pile. For the rest, the cave is dark.

Countless bats have for centuries been swarming in the cave and through the passages and rooms connected therewith, whenever the weather is cool. The floor of the cave is covered by a layer of guano, the deposit of those bats, and by myriads of carcasses of such as died and decayed long since; which last is evidenced by numerous small bones found mixed in. That layer of guano has

been probed to depth of twenty-five feet and no bottom reached. Guano is also found in stretches on the sides of the cuneiform pile to a height of fifty feet; and further up, mixed with stone and dirt, clear to the top.

Where the foot of the cone is farthest from the wall of the cave, is a huge stalagmite, about fifty feet high, translucent, white and hollow. At its base is an open arch, through which one can climb and ascend on the inside to a height of about twenty-five feet, when one is stopped by a spring of very clear water. This water streams down to a basin hollowed in the bottom of the stalagmite.

Between the stalagmite and the side of the cone is a gigantic block of white onyx, about oblong at the base and nearly circular at the top. It tapers upwards to a height of fifty feet. The width of front and back at the base is forty feet, the thickness thirty feet. At the top, where the shape is circular or almost so, it is eight feet across. Projecting rocks can be used as an irregular stairway for ascending to the top. About half way up is an opening. The block is hollow and divided in cells, through which one can wind one's way. A light carried inside is dimly perceptible outside, through considerable thickness, the onyx being sufficiently translucent for an outsider to follow with the eye the course of the person inside carrying the light. The outside is decorated by water formations in the shape of columns and draperies; and on the stone appear like rude carvings in relief of human faces. This block has been named the "Great White Throne."

From the arched wall of the cave, behind the "Great White Throne," hang down over 1,000 stalactites, varying in length from a few inches to twenty feet and in color, crystalline, white, yellow, and red; here and there interlacing and forming what looks like delicate net-work.

From the top of the roof, where it begins to be vaulted, yellowish stalactites of various sizes hang down in groups. Touched for a moment by the rays of the noon sun, the tips glisten beautifully.

Fifteen passages lead from the cave in various directions, farther into the mountain. Their walls, like those of the cave, are of marble, flint, onyx, and granite, in layers. To any one making the round of the cave, starting from where the wall presents the widest space without any opening, and moving with the wall on the right hand, the rooms present themselves in the following order:

1. The largest, thirty feet wide and fifteen feet high, divided into two unequal parts by a pillar, is the Emery Avenue, after Capt. J. B. Emery, postmaster at Lamar, Mo., the president of the company which owns the cave. This passage is only about ten feet long and leads into a room 250 feet long, thirty feet wide and from ten to twenty feet high, the floor slanting and saddle-shaped near the middle. This room is called the Mother Hubbard Room, by reason of a rock in the shape of an old woman with cape and hood, bending from a stool over a grate, near what seems to be a cupboard in the wall. This room ends in a mass of rock piled up irregularly. Same kind of rock as in the cave, and floor thickly covered with guano. In this pile of rock is a narrow passage through which one has to creep. It is thirty feet long and ends in a room about twenty feet wide,

thirty feet long and forty feet high. This room, during cool weather, is so filled with bats that they completely cover and hide the wall all around, giving it the appearance of black velvet. Whenever disturbed they fly about in such numbers as to put out any light not protected by a lantern, and incessantly flap against one's face. Hence the room is called The Battery. A very thick layer of guano covers the floor. At the further end is a small stream of water, about three inches deep and three feet wide, all saturated with guano, and running onward between rocks. A boy, Dick Powell, son of a member of the cave company, followed the stream for a distance of 100 feet and then, coming to a precipice, turned back. Through the passage from the Battery to the Mother Hubbard Room, a strong inward current of air constantly forces itself. Therefore this passage has been designated as the Inward Wind Passage.

2. A second passage, about three and a half feet high and the same in width, is called the Outward Wind Passage, by reason of a current of air rushing from the cave with such force as to extinguish any light not in a lantern. It has been explored only about 150 feet, at which point progress is stopped by cross stratum of onyx, dividing the passage and rendering it too narrow. A large fire of pine knots once was kindled in it, and the draft carried the smoke off without hindrance. Probably it leads to an opening in the side of the mountain.

3. A third passage, slanting with an incline of 45°, and circular like a hole, three and a half feet in diameter, leads to a room about thirty feet long, ten feet wide and fifteen feet high. This room is called Powell's Room, after T. S. Powell, vice-president of the company, who discovered it. A short straight passage, also a creepway, leads from this to a similar room, in size half of the former. Another creepway connects this second room with a third still smaller, in size about one-third of the first. The floors of these three rooms are vast deposits of guano, depth unknown. A fourth passage leads farther on but has not been explored, because it has been greatly stopped up with guano. The walls of these three rooms are smooth blocks of white onyx and dove-colored and red marble piled up.

4. A fourth passage, in size similar to the former, runs down at an angle of 45°, to an almost circular room about fifteen feet in diameter and ten feet high. This room seems to have been a den of bears, as the ground, also a guano bottom, is strewn with bones of bears. Waste water, from the spring in the cave, runs through this room and into a farther room, visible but not accessible along the stream. The guano is partly spoilt by the water. Rock, marble and onyx.

5. A fifth passage, the most tortuous of all, circular in shape, about 190 feet long, and at some points only two and a half feet high, leads to a room of serpentine shape, not over three and a half feet in height. The floor of this room is brilliant red clay, very strongly impregnated with saltpetre. Here neither bat nor guano is found. But the room, the length and width of which has not been accurately ascertained, is filled with mummified animals. There are bears, panthers, otters, racoons, opossums, wolves, foxes, lynxes, etc., and one specimen of what seems to be an antediluvian animal of the genus pterodactylus. Also

smaller animals, seemingly some kind of monkey. These mummies are in an attitude of repose, as if the animals had come here to die. Hence the room is called the Cemetery. Hair on the dried up skins is well preserved. The roof of the room is marble. The sides, so far as seen, are a glistening quartz, believed to be silicate of zinc, but not yet analyzed. What may be beyond this room has not been ascertained.

6. A sixth passage is located at the rear of the spring. It is about two feet wide and forty feet in height, and tapers toward the top. It really is a crack, about thirty feet long, in the rock, level and straight. Red, white and brown stalactites hang down from the roof. They reach so low that one has to creep under them. It ends in a circular room, about twenty feet in diameter. The roof, about fifty feet high, is conical. Water constantly falls from points all over the ceiling, as if that were a colander or sieve. This creates a perfect shower. The water escapes through interstices between blocks and fragments of rocks which constitute the floor. The sides of the room are enveloped in water-formations, and the sides of the roof are covered with bright, brown stalactites. An immense stalactite hangs from the center. The room is called the Shower-Bath Room. The space below has not been examined. Neither has it been ascertained where the water goes to.

7. A seventh passage has a round opening three feet in diameter, and retains that shape. It winds and at first is level, but soon begins to slope. The ground is strewn with small bones and teeth. It seems to lead to the space whither flows the water from the last described room, but as yet it has been explored for only a distance of 100 feet.

8. An eighth passage is about six feet wide at the opening and three and a half feet high. It gradually increases in height until, at a distance of forty feet from the beginning, it is six feet high. Up to that point it is level; but now it descends and widens, the roof remaining level, until at a distance of 140 feet from the beginning, it is twelve feet wide and forty feet high. The ground is granite and red clay. The passage ends in a room called the Blow Room, after the late Hon. Henry T. Blow, of St. Louis, who in 1869 penetrated thus far and chiseled his name in the wall. The Blow Room is about 100 feet wide, 250 feet long and 100 feet high. The floor, also of granite and red clay, is level in the center but slopes both ways. On one side is a hole forty feet wide, opening upon a precipice 130 feet deep. At the opposite side is a round shaft, six feet across, partly covered by a great slab of rock. This shaft is thirty-two feet deep. It ends in the roof of a nearly level passage, about ten feet high and six feet wide. After having followed this passage in one direction for forty to fifty rods, one crosses a stream of clear water, about ten feet wide and one foot deep. The passage then widens and becomes the cañon of the stream, which one has to cross and recross. Occasionally it gets lower, so that one has to creep. From time to time it expands into rooms, none over twenty feet high, twenty feet wide and varying in length from thirty to fifty feet. This passage has been followed for a distance of two miles, and upwards of twenty rooms have been passed. It is

tortuous, monotonous, has no water formations on walls or roof, descends with the rapid current of the stream, and has in some places a rough, and in others, a slippery floor. The rock is granite of beautiful colors and of a high degree of fineness. The emery rock already mentioned also shows itself in some places. The passage might be followed farther; but has not been yet from lack of time. Bats are still occasionally found. Some guano, but not in beds; probably the water has mostly carried it off. Following from the bottom of the shaft the same passage in an opposite direction, one descends more than when moving the other way. It winds round, and while it continues (about which more anon) soon therefrom branches off another passage. This traverses four rooms in succession, and ends by reaching the bottom of the precipice, first seen from the great gap in the wall of the Blow Room. The four rooms average about twenty feet in height, and vary in width from ten to twenty-five feet and in length from thirty to sixty feet. Three have projecting ledges running all around along the sides, interrupted only by the openings of the passage. One can walk over those ledges as in a gallery. The floors slant and are, as well as the walls and roof, of granite and yellow and variegated marble. Very little guano. Here and there are holes in the floor, showing underneath similar rooms of less height. In these lower rooms are several small, swift streams of very clear water, running in different directions.

The room constituting the precipice is 230 feet high, nearly circular, and seventy-five feet in diameter. It is called the Voice Room, because frequently sounds are heard there, so strikingly resembling human voices that an explorer, on first entering it drew a revolver in self-defense. Probably they are echoes of falling water, and depend on the rush. The lower part of the Voice Room is emery rock, the upper part granite, between which two the top of the precipice, or level of the Blow Room, is about the dividing line. Opposite the passage through which one has entered, is a kite-shaped crack in the wall. This crack runs up about twenty feet. Near the top it is about twenty feet wide, and at the bottom the sides close together in a point. It is the entrance of an almost straight passage which retains that shape, and first descends, at an angle of 45°, but later becomes a little less steep. The crack grows larger at the top and higher, till it reaches sixty-five feet in height and, near the top, forty feet in width; but at the bottom it always remains, coming to a point. Here and there in that bottom are holes affording a view of rooms below, to a depth of about thirty feet. It is all emery rock; no other rock is any longer met with. It leads into what is called the Waterfall Room. This room is crescent-shaped, and about 100 feet high. One enters it at one of the corners of the crescent. From there to the opposite corner is about 200 feet. About the center it is thirty feet feet wide. Near this center, about the middle of the outer line of the crescent, is a recess in the shape of a horse-shoe. The two points of the horse shoe are fifty feet apart, and the curved line between 125 feet. The wall of this recess is perpendicular and sixty feet high. Down it falls, with great force, a large body of water coming from rooms above. One can pass behind the fall; between it and the wall. The spray is such as to extinguish, anywhere in front, a light not

protected by a lantern. The entire floor of the Waterfall Room is covered with beautiful water formations, resembling the figures on a carpet, but standing out in relief. The walls are similarly covered, the formations looking like pails, baskets, etc. In front of the fall are jug-shaped basins, varying in depth from one to two and a half feet, and in width from six inches to three feet, with openings only big enough for the insertion of the hand. The water streams in them, and probably passes out again through small cracks; which matter, however, has not yet been ascertained, nor what becomes of the water. These basins contain white, soft, blind, toothless lizards, from two to six inches in length. The roar of the waterfall, and of other falls below not yet reached, is such as to render conversation in any portion of the room impracticable.

At the opposite corner of the crescent is an ascending passage about four feet wide. The roof of this passage is a continuation of that of the Waterfall Room. The floor is of red clay, very slippery, into which steps must be cut, as the angle is 45°. The passage is nearly straight and about 100 feet long. It ends in a room sixty feet above the level of the floor of the Waterfall Room. This room, which one enters by a turn to the left, is about ten feet high. It contains one large spring and a cluster of smaller ones. In a backward direction it is connected by a passage about forty feet long and four in height and width, with a similar room, also containing springs. This second room is, by a similar passage, about twenty feet long, connected with a third room of the same kind. The two first rooms are about of a size, but the third is smaller. The third room contains the head of the waterfall; and the springs in the rooms last mentioned furnish a portion of the water. These rooms and the connecting passages are together between 300 and 400 feet long. The rooms are about thirty-five feet in width. From the first and second rooms, passages lead to other rooms beyond, but these have not been explored. Water also flows from those unknown farther rooms. The waterfall is fed, not only by the springs above described, but also by a swift, shallow stream, about thirty feet wide, coming through a low cañon. This cañon has been ascended for a distance of about 700 feet, and might be farther explored. The entrances to ten passages, all but one ascending, and with water running through them, were passed. Half of these passages are on one side, and the balance on the other, of the cañon, at very irregular intervals. They have not been examined, except the second to the left, which descends and is dry. That passage is about eight feet wide and four feet in height. Its entrance is dammed by rock and water formations. The passage gradually increases in height, until it reaches ten feet. It winds and is about 200 feet long. It opens on a semicircular room. The descent to that room is very slight. The room is over sixty feet high; greatest width twenty feet; length of outer curve 250 feet. The walls are emery rock and red clay; preponderance of red clay. About one half of the floor is covered with a thick layer of fine guano. The uncovered balance shows the red clay. The entrance is at one end. At the opposite end the wall does not go clear to the top, but runs up to a height of thirty feet. It is a heavy bank of red clay, studded all over with pointed pieces of mica, of

about the length of a finger, glittering like diamonds and soft enough for chewing. About the middle of the outer curve, thirty feet above the floor, in the outer circular side, is a hole, about six feet in height and four feet in width, the entrance of a passage about twenty feet in length, which ends at a precipice of unexplored size. Rocks thrown down that precipice are heard to strike the bottom in the time required to count twenty-one.

Near the clay wall is a winding and gently descending passage, about four feet wide and from five to ten feet high. It leads in succession to three rooms, which average twenty feet in height and twelve feet in width, and are semi-circular, and with arched roofs. In length they vary from thirty to fifty feet. Some guano, but no great quantity. Passage and rooms together about 500 feet long with emery rock and red clay. This passage, always descending, ends in the one which passes the foot of Blow Room shaft. The point of junction is 200 feet from the bottom of the shaft. Between these two points is the entrance of the passage taken when going toward the Voice Room, so that a circuit has been made. The passage in the roof of which the shaft ends, continues beyond the point of junction just described, but has not been farther explored.

This entire part of the inside of Roark Mountain, is one vast labyrinth of caves and passages, the one above the other and as yet only partly known.

9. A ninth passage has its entrance fifteen feet above the bottom of the cave. That opening is wedge-shaped; the base is three feet, and the sides come together at a height of ten feet. The passage retains that shape. It is level and smooth at the bottom, but the sides are rough and only a small sized person can enter. This passage is sixty feet long. It leads to and ends in a small triangular room. The floor of the room is an isosceles triangle, each side twenty feet. The roof is pyramidal and about fifty feet high. From the top stalactites, clear as crystal, from one to five feet long, hang down. The sides are covered with crystals of translucent onyx. On the bottom is but little guano, as the bats seem to prefer smoother roofs and larger rooms. Water formations so completely encrust the walls that the nature of the rock has not been ascertained.

10. A tenth passage is a crack in the wall of the cave, near the point where the foot of the cone-shaped pile comes closest to that wall. The crack is wedge-shaped and seventy feet high and three feet wide at the bottom, the sides coming together at the top. The passage thus made is rough from protruding flints, and descends at an angle of 45°, until, at a distance of sixty feet from the starting point, it is intersected by a precipice forty-six feet deep. Across the precipice, leaving a gap of about six feet, is a projecting ledge about two feet thick. The passage continues across this ledge, but becomes much narrower and has not been further examined. Descending the precipice with a ladder, one finds an oblong room about fifteen feet wide and twenty feet long. The top is on a line with that of the passage, except in so far as the projecting ledge mentioned intervenes. The bottom is very thickly covered with guano. Sides perfectly plumb and as smooth as masonry, of dove-colored marble. In the wall under the ledge is a hole about five feet high and three feet wide, through rock

two feet thick. This hole gives access to another similar room, the floor of which is on a level twenty feet lower. That room too, is oblong. It is fifteen feet wide twenty feet long and twenty-five feet high. Walls like those last described. In both these rooms the layer of guano which covers the floor is at least ten feet thick, as with a pole of that length, bottom could not be reached. The first of the rooms is called the Jones Room, after Dr. T. Hodge Jones, secretary of the cave company, who was the first to explore it. The second the Arnold Room, after F. D. W. Arnold, treasurer of the same company; for a similar reason.

11—15. Where the foot of the cone approaches closest to the wall of the cave is a recess in that wall. Five passages, all low and narrow, lead from that recess. They are about three feet high and three to four feet wide, and slope gently downwards. Each leads to a series of small rooms of irregular shape. Only nine of these rooms have been visited. Passages and rooms both have been but imperfectly explored. The rock in them, and even in the recess of the cave, is of an alkaline nature and crumbling. Everywhere are loose stones and debris. The rock easily slackens and pulverizes. An acid causes it when pulverized to effervesce. The application of water hardens it into the likeness of plaster-of-Paris. The color is light gray. It has not been analyzed. No guano here. The bats avoid this place; probably because the rocks in the roof are apt to tumble down. This same circumstance has retarded more thorough exploration.

The temperature of the cave is 56° F. during the hottest season. It rises slightly in rooms and passages below. Whenever the weather is cool, a person sitting on the top of the cone at the foot of the ladder, can see myriads of bats sweeping down the mouth of the cave.

The "Wilderness Road," a wagon-road leading from Springfield, Mo., into Arkansas, passes within four miles of the cave. These four miles can be traveled over by a remarkably good natural road, with beautiful scenery all the way. Springfield is forty miles from the point where this road strikes the Wilderness Road.

Forsythe, the head of navigation on White River, during the high water of spring, is fifteen miles in a straight line from the cave. It is the county seat of Taney County. Galena, the county seat of Stone County, is also fifteen miles off, and Ruth, distant six miles, in the same county, is the nearest postoffice.

Capt. Emery, in a private letter, says that while the above description may be in some points slightly overdrawn, it is in the main very correct, and that "not half of the wonders of the cave are told."—[Ed. Review.

A NATURAL CURIOSITY.

About two miles south-east of Santa Paula and near the foot of the mountains is a natural curiosity. The rocks, which were once doubtless impregnated with petroleum, have undergone oxidization, all the bituminous matter having been burned out. They consist of horizontal strata of sandstone, some coarse and others fine grained. The oxidization bears evidence of having taken place ages since and to have extended to a great depth. As a result of these internal fires, a circular district, some five or six hundred yards in diameter, has sunk to the depth of about one hundred feet, leaving an opening on the west side. A conical hill rises in the centre to the height of nearly one hundred feet, capped with sandstone. The perpendicular walls extend nearly around the depression, showing a fine exposure of stratified rocks of various colors. Those containing most bituminous matter are left more highly colored and present a pleasing contrast to the gray layers that were less affected by the heat. About a half mile from this amphitheater and a thousand feet higher up the mountain is a solfatara similar to what this one was at the time, and from which hot air and steam are still escaping. Mr. George Richardson, who owns the land upon which the solfataras are situated, informs us that the living one was much more active sixteen years ago when he first came to this place. The places described are well worth visiting.—*Ventura Free Press.*

ENGINEERING.

THE NICARAGUAN CANAL.

ADMIRAL DANIEL AMMEN.

While there are other considerations which might determine our government to execute a great work such as the Nicaragua Canal at even a commercial loss, it is obvious that a limit exists beyond which action should not be taken; such for example, I would say, as the sea-level canal at Panama, involving primarily from its physical conditions enormous outlays, entailing great uncertainty of results, and certainly great outlay for its maintenance in a navigable condition, and from time to time serious delays from land slides into the canal. The subject presents itself as abnormal, distasteful, and unnatural if not considered commercially. What will the canal cost, and what for its maintenance? What will be the minimum traffic, and what period of time will be necessary to execute the work?

On the present location the engineer's estimate for labor and material is

$41,193,839. In every construction of this kind what is known as a contingent fund is requisite for machinery, superintendence, unforeseen difficulties, delays, interest on money, etc. More recent examinations assure the fact that the canal location can be very materially improved, but as this has not yet been effected instrumentally, no reduced estimate for labor and material is admissible, and, although considerable will result, it will not be taken now into account. Over the present line of location the cubes are well ascertained, and the character of the material to be excavated is approximately known. The estimate for dredging where the material can be flumed into its place of deposit is thirty-five cents per cubic yard. Improved machines make this estimate excessive, and there will be not less than fifteen miles of dredging of the fifty-three miles requiring excavation, if further location does not reduce this ten miles or more, which is highly probable. On the eastern section 24,064,053 cubic yards in earth is given at thirty-five cents per yard. More than half of this can be dredged and flumed to its dumping ground at a cost not exceeding one-third of the estimate. Rock excavation in the San Juan River is given at $5.00 per cubic yard, when it can be contracted for at a considerably less figure. The reader will bear in mind that all of the engineer's estimates were doubled by the canal commissioners appointed by the President, and will also be here in stating the maximum cost of the canal at $82,387,678.

The engineer's estimate for earth was thirty-five cents; for stiff clay, forty cents, and for rock "in the dry," $1.25 to $1.50 per cubic yard. The dumping grounds throughout are very convenient, as they may well be on a lock canal, and there are no cuts of more than forty-five feet in depth above the water level, and they are quite short. The mean cut above the intended water level of the canal is less than ten feet, and the deepest fills are three feet below it. As all of the excavations can be made with sufficient natural drainage, except the parts that can be dredged, the most economic conditions exist for the execution of every part of the work, and this would not be the case were it a sea-level canal, where blasting and removing rock must be a slow and expensive operation.

The engineer's estimates were not made to favor the construction of the work; they were made for the government. With a contingent of twenty-five per cent, which perhaps would prove too small, it is not at all improbable that the cost of the canal, when executed in the best manner, may not exceed $65,000,000, interest included. Without sacrificing economy nearly every part of the construction can be entered upon at the same time, and for this reason the canal may be open for traffic within five years from this date.

Admitting the maximum figure for construction instead of the last named, let us consider a minimum figure of tonnage and of transit dues. Of immense importance to us prospectively is our coasting trade which would pass through it. One million tons for the present would be a low estimate, and in less than half a century it would be five times that amount. The grain product for export to Europe of the north Pacific Coast now exceeds 2,000,000 tons, and the vessels partly laden with iron and coal and partly in ballast, going through the canal for

cargo, would be not less than 1,000,000 tons. Then we have the traffic to and from Japan, northern China, the Phillipine and Sandwich Islands, the islands of the south Pacific, New Zealand, and Australia, to and from our Atlantic Coast and European ports. One million tons would be a small estimate. We have then 5,000,000 tons plainly in sight as soon as the canal is open for traffic, and will leave the traffic of the west coast of South America to the Panama Canal; upon the hypothesis that it will actually be completed. With canal dues of $1.00 per net ton and deducting $1,000,000 for maintenance of the canal and for towage, we have $4,000,000 for dividends, which is a small fraction below five per cent on $82,378,678, the maximum cost of the canal arrived at by doubling the engineer's estimates.

But a traffic of enormous proportions will develop from the construction of the canal, without which it would be impossible; the timber traffic from Puget Sound extending northward even to Behring's Strait, to our eastern coast, and to Europe. In order to have a conception of what this will amount to, let the skeptic visit the Liverpool steamer Oregon and examine the thirteen splendid timbers in bright colors from the State of Oregon, with which that vessel is finished. The yellow cedar when finished is as beautiful as satin, is as easy to work as cypress, and surpasses oak in durability. All of these timbers are superb and are to be found in enormous quantities convenient for shipment, and can be put on board of sailing vessels and auxiliary propellers at small cost and with munificent profits, and can be sold in Europe at certainly below the market price, at this time, of ordinary pine plank; add to this the constantly increasing wine product of California, and we see at once what a mine of wealth the construction of the Nicaragua Canal will bring to all of the inhabitants of the west coast, and what an amelioration it will prove to those of our east coast and to Europe.

We may well conceive that the earnest commencement of the construction of the canal would serve at once to establish our ship-building interests and our iron trade, upon which almost all the prosperity of our industries depends, and thus revive the entire traffic of our country. We see in this timber traffic that the canal dues will soon have to be reduced to fifty cents per ton to avoid a revenue far above the usual rate of interest paid on an investment.

Such persons as may object to a government construction of the work are reminded that our citizens holding a concession were unable during a period of years to obtain of Congress a simple act of incorporation. It is idle now to inquire into the influences that prevented; the question now is presented in its simplest form.

Statesmen may perceive the advantage of our Government constructing the canal rather than abandoning it to another government. They may perceive, too, that after developing the commercial certainty of this canal the nonconstruction of it by us will not prevent its construction by others. Were it only for the purpose of silencing the question politically, it would seem cheap to construct it were the cost ten times the amount of the sum named. It would prove a far

better economy than spending double that amount in war, which would seem altogether a probable result from non-action at this time. If we do not now determine on the construction of the canal ourselves, we certainly would have small reason for complaint were Nicaragua to grant a similar concession to any other power to that agreed upon with our Government.—*National Republican.*

METEOROLOGY.

METEOROLOGY OF THE MOUNTAINS AND PLAINS OF NORTH AMERICA.

CAPTAIN SILAS BENT.

We extract the following from an address delivered at St. Louis, Mo., November 18, 1884, before the Cattle-Growers' Convention, upon the subject "Meteorology of the Mountains and Plains of North America, as Affecting the Cattle-Growing Interests of the United States." Captain Bent has given the subject of meteorology deep study, and his views carry weight with all western people, at least.—[ED. REVIEW.

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These plains extend from Texas to Canada, about twelve hundred miles in length and with a width eastwardly from the base of the Rocky Mountains of about three hundred miles, making an area of 360,000 square miles, or upwards of 250,000,000 acres of land which, with rare and limited exceptions, are fit only for grazing, and can never be profitably used for any other purposes. The laws should, therefore, be amended by adding another, or "Pastoral," grade to the Public Lands Schedule, and with authority for leases alone to be made to persons wanting such lands in tracts of not less that 20,000, nor more than 300,000 acres to each lessee, for terms of twenty years, which would prevent these lands being monopolized by a few persons to the detriment of others, and would yet give to the tenants security in those proprietary rights necessary to prevent trespassing by others, or disturbance from Government agents or officials.

As I have before intimated, these lands can never be converted into agricultural lands, notwithstanding the various schemes proposed from time to time for their irrigation and reclamation from agricultural sterility; for there are physical causes for that sterility which neither the power nor the ingenuity of man can change, and it has been thought that a brief discussion of these causes might not be uninteresting to the members of this Convention, and I have been asked to give you views in regard to them.

To do this will, of course, involve a wider range of investigation than if the

simple facts and conditions of the problem were accepted without going back to their origin or cause through the meteorological processes by which these facts and conditions are brought about.

I will first call your attention to this skeleton map of North America, where only the main ranges of mountains, chief lakes and principal rivers are laid down, other details being omitted so as to prevent confusion.

The principal range of mountains extending through Central America into Mexico is a continuation of the Andes of South America. In Mexico, however, these mountains are known as the "Sierra Madre," or "Mother Range," and which throws off two branches—one to the northwest along the Pacific Coast into California, where it is known as the "Sierra Nevada" or "Snowy Range," and which runs thence up into Oregon, where with a lower altitude to the range, it assumes the name of the "Cascade Mountains," and where it is broken into a number of detached, isolated but majestic peaks, such as Mounts Jefferson, Hood, Adams, Ranier, St. Helens, etc., etc., which stand as hoary sentinels surpliced in eternal snow to mark the gateways through which the moisture-laden winds from the Pacific Ocean gain access to the heart of tne continent.

The other and in many respects the grander branch from the Sierra Madre is the Rocky Mountain Range, which runs almost due north about the 110th and 120th meridians of longitude, until reaching the parallel of 45° N. latitude, where this range sinks to an elevated "divide" of from 6,000 to 8,000 feet above the level of the sea.

Lying between these ranges, and extending from the Sierra Madre to the Yellowstone Park, lies a plateau or plain of comparative sterility and barrenness, comprising much of the territories of Utah, Arizona and Nevada.

With this preliminary description of the map, I shall now proceed to discuss some of the meteorological phenomena that have a direct bearing upon the question before us.

It is generally believed that the sun is the direct evaporator of humidity and especially of the ocean waters, and that the evaporation from the oceans is mostly from the equatorial regions of the earth, and that the vapor from this evaporation is transported by the winds through the upper regions of the atmosphere directly north and south, to its points of distribution in the temperate and frigid zones.

This, however, I think is a fallacy, and that in reality, notwithstanding the enormous evaporation that does undoubtedly take place in the equatorial regions, by far the greater part of that evaporation is precipitated back to the earth's surface within the tropics, and that by quite a different process are the regions of the earth beyond the tropics supplied with water from the heavens.

The sun's rays being more nearly vertical within the tropics, have so much the more heating power, and the surface waters of the oceans there are thus brought up to a general temperature of 88° F.; from whence this heated water is carried north and south to the earth's extremities, by grand ocean streams, which are the life-giving arteries of the oceanic and inter-oceanic circulation.

Of these streams there are four, the two grandest and greatest of which are thrown off to the southward, from the equatorial currents of the Pacific and Indian Oceans; whilst the remaining two are thrown off northwardly from the tropics into the north Atlantic and Pacific Oceans. The first of these latter is the Gulf Stream, whose general character is familiar to us all. The other is the Kuro-Siwo, of more recent discovery, which starts from the southeast coast of China, and running northeastwardly with a velocity of from thirty to eighty miles a day, and losing only 1° of warmth for every 300 miles that it travels, washes the south coast of Japan, and spreading a mantle of tepid water of upwards of 70° of temperature over the surface of the north Pacific, envelops the whole west coast of our continent from Behring's Straits to the Equator with its genial warmth, and gives to that region the delicious climate which is now becoming so well known to us all.

Now, whilst the sun by its heat in the tropics has prepared these waters for rapid evaporation by giving to them their high temperature, yet the sun itself cannot and does not evaporate any portion of them, except through the medium of the atmosphere. And the power of the atmosphere to produce this evaporation is in exact proportion to its low temperature and its dryness as compared with the water at the time of its contact with these tepid waters from the Equator.

The prevailing winds in the temperate zones are from the westward. The west winds which come to the north Pacific from the plains of Central Asia and Siberia are cold, contracted and dry, with a temperature frequently below the freezing point, so that when they reach the tepid waters of the Kuro-Siwo they at once respond to the warm and expanding influence of these tropical waters, and as they expand drink up by evaporation prodigious quantities of the latter, which, as invisible vapor or fogs, are borne eastwardly across the surface of the ocean to the west coast of our continent.

That portion of these winds that reaches our coast about the mouth of the Columbia River are chilled by the Cascade Mountains, and made to yield such quantities of rain as to have produced a forest growth of vegetation so rank and majestic as to be unrivalled by any other forests of North America; and just north of the Cascades come the open gateways through the mountain ranges, guarded only by the detached and hoary peaks before named, between which these west winds carry their burdens of warmth and moisture to gladden and fatten the face of the interior of the continent, but which on their way pay such tribute to these majestic sentinels as to clothe and crown them in the purity of everlasting snow, and then reach the elevated region of the Yellowstone Park with still abundant moisture, which is dealt out from their hitherto invisible treasures with such royal profusion as to give birth to and keep in perennial flow the grandest system of rivers on the face of the globe, viz: the Columbia, McKenzie, Saskatchawan, Assiniboine, Yellowstone, Missouri and Colorado, which, radiating north, east, south and west from this immediate region, and with courses of thousands of miles, each distribute their waters into all the oceans surrounding

the continent. This may, therefore, be not inaptly called the "*Water Dome of North America!*"

Stretching eastwardly from this "Dome" to the mouth of the St. Lawrence River on the Atlantic Coast, lies a declining ridge, from which waters run north into Hudson's Bay, and south by the Mississippi, Illinois and Ohio Rivers and their tributaries, into the Gulf of Mexico, and east of the Alleghenies by the Potomac, Delaware, Hudson, Connecticut and other rivers into the Atlantic Ocean.

Besides all these mighty rivers that have their geneses in the direct pathway of these west winds across the continent, and cradled upon the crest of the ridge just described, lie the great Lakes of Superior, Michigan, Huron, Erie and Ontario, which alone are estimated to contain one-half of all the fresh water resting upon the face of the earth, and which, notwithstanding the necessarily enormous drain from them by evaporation, yet have always such a surplus of water as to keep in unvarying flow from them the majestic St. Lawrence River.

Now the waters which supply the rivers radiating from what I have termed the "Water Dome," all come from this west wind from the Pacific, as I believe do also those which supply the other rivers in the Mississippi basin west of the Allegheny Mountains, together with those that fall into and make the great lakes. Whether or not the waters that go into the rivers east of the Alleghenies come from the same source is doubtful. I think, however, that through local agencies, they come from the gulf stream of the Atlantic. Yet it is not unreasonable to believe and affirm that by reason of the waters that do come from the prevailing west winds from the Pacific that it is the *Kuro-Siwo of the Pacific that irrigates and fructifies the heart of the continent of North America.*

Now it may be asked, what has all this to do with the aridity of the alkaline plains of Colorado and New Mexico? Very much, as I shall endeavor to show, by first calling your attention again to the water supply that is carried under the wings of this west wind from the Pacific Ocean and distributed nearly, if not quite, across the continent (when not interrupted by the condensing power of intervening mountain ranges,) since that is the gauge by which the quantity of water carried by these winds can be measured; and if found in one portion of these winds, it is not unreasonable to believe that other portions of these same winds carry a corresponding quantity. But let us now see what becomes of that supply from that portion of these winds which strikes the land south of Oregon, and which, being slightly chilled by the coast range of mountains and hills, give out moisture enough to envelope the coast with fogs and clouds during many months of the year. Passing thence into the interior, these winds are thrown upward against the cold flanks and peaks of the Sierra Nevada, where being condensed, they crown the latter with their coronets of eternal snow. Descending the eastern slope of the Sierra Nevada Range, these winds reach the plateau of Utah and Arizona before described, so robbed of moisture that the earth's sterility is but the evidence of its unslaked thirst.

Continuing eastwardly, these west winds then climb the western slopes of the

Rocky Mountains, but without moisture enough in them to clothe with vegetation the rock-ribbed walls whose sombre and rugged nakedness attest the infrequency of rains upon them. Still the altitude of these mountains is so great, and therefore so cold, that their supreme peaks wring from the shrinking winds what little moisture remains in them, to add sparkling coronets of snow also to their majestic heads. But these winds, pitching thence down the eastern slopes of the Rocky Mountains, reach the plains of Colorado and New Mexico so completely dry as to be unable to give forth even a morning dew, and hence the alkaline sterility of these plains, which no human intervention can change or alleviate.[1]

Now I hope it has been made apparent that these plains, as well as the plateau of Utah, Nevada and Arizona, owe their sterility to no accidental nor remedial cause, but to the immutable laws of Nature, which are not to be changed by man, and that these lands, as they stand, and will forever stand, are not fit for agricultural cultivation, except in rare localities along the water courses, but are especially fitted for grazing and cattle growing, and in my judgment should,

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1 If this meteorological hypothesis is correct, then similar phenomena should be found on the other continents.

Let us see if that is the case.

The west winds which we have followed across North America, on leaving our eastern shores, are cold, compact and dry, but as soon as they reach the tepid waters of the Gulf Stream, they at once respond to their warming influence and rapidly expand, and in expanding, take up by evaporation enormous quantities of water from the ocean, which they carry as invisible vapor or fog eastwardly across the Atlantic, to clothe the British Islands and Western Europe with their emerald robes of vegetation. Then that portion of them that is intercepted by the Alps is chilled and contracted so as to cap these mountains with perpetual snow, encircle them with profound lakes of marvelous beauty, and give birth to and feed the splendid system of rivers which, radiating from this "Water Dome" of Europe, discharge their waters into all the surrounding seas. Among these latter may be named the Elbe, Rhine, Saonne, Seine, Rhone, Po, Adidge and Danube.

The more northerly portion of these winds from the west, deflected somewhat by the Carpathian and Altai Mountains, pass eastwardly across Northern Russia and Siberia, and carry in their wings the water that gives birth to and feeds the Obi, Yennessi, Lena, and other grand streams that empty into the Arctic Ocean, and finally reach the Pacific as the cold, dry winds first spoken of.

It may be said, therefore, that the Gulf Stream of the Atlantic irrigates and fructifies the continent of Europe and Northern Asia.

Southern Asia receives its humidity from the tepid waters of the Indian Ocean, by means of the northeast and southwest monsoons, which prevail there.

Africa, being a tropical continent, is traversed by the trade winds, which blow from the eastward. These winds, saturated with moisture by evaporation from the hot waters of the great equatorial current that strikes the east coast of Africa, after its journey of 15,000 miles along the Equator from the west coast of America, sustain the rank vegetation which belts this continent in the tropical region, from the Indian to the Atlantic Ocean; crowns the mountains of the Moon with the magnificent lakes of Albert and Victoria, Nyanza, Tanganika and others, and keep in perennial flow from this "Water Dome" of Africa the majestic Nile, Congo and other rivers radiating from thence to the surrounding seas.

The great equatorial current of the Pacific and Indian Oceans, therefore, irrigates and fructifies the continent of Africa, through the agency of the trade winds.

In the same way is South America irrigated and fructified from the equatorial current of the Atlantic, by waters evaporated from it by the trade winds, from which their moisture is wrung by the cold flanks and yet colder summits of the Andes, from which flow into the Atlantic waters, the Orinoco, the Amazon, and the Rio de la Plata, with their myriad of tributaries; but when these winds have scaled the Andes, the extreme cold of the latter has so contracted and wrung from them all their moisture, that when they pitch down upon the west coast of Bolivia and Peru, they are as rainless as those arid winds which cause the alkaline plains of Colorado and New Mexico.

as a whole, be set aside by the Government for the encouragement of that industry alone, since the watercourses and water privileges are imperatively required by the ranchmen, and without which all the rest of the grazing plains are practically worthless.

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St. Louis, Mo.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

Temperature of the Air.	Jan. 20th to 31st.	Feb. 1st to 10th.	Feb. 10th to 20th.	Mean.
Min. and Max. Averages.				
Min	-10°.	-16.75°	-17.5°	-14.7
Max	45°.	50°.	31.	42.
Min. and Max	17.5°	16.75°	6.7	13.65
Range	55°.	76.75°	48.5	56.75
Tri-Daily Observations.				
7 a. m.	11.4	23.1	-9.5	8.3
2 p. m.	21.0	31.1	16.7	24.6
9 p. m.	15.5	24.7	9.4	16.5
Mean	17.1	25.9	8.6	16.5
Relative Humidity.				
7 a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Mean	. .	. .	. .	. .
Pressure as Observed.				
7 a. m.	29.219	28.905	29.080	29.068
2 p. m.	29.116	29.082	29.132	29.110
9 p. m.	29.192	29.018	29.139	29.116
Mean	29.176	29.001	29.117	29.099
Miles per Hour of Wind.				
7 a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Total miles	2765	3737	3024	9526
Clouding by Tenths.				
7 a. m.	6.3	5.6	3.0	4.9
2 p. m.	2.5	3.5	2.3	2.8
9 p. m.	4.4	5.0	4.9	4.7
Rain.				
Inches	0.54	0.03	0.3	0.60

Snow storms occurred January 22d and February 8th, 14th and 19th. The fall was only two or three inches at any one storm. The prevailing winds as usual at this season have been northerly. "Blizzards" prevailed January 27th and February 9th.

From January 20th to February 20th, the period embraced in this report, there has been steady cold weather with but little snow.

On the 10th of February the temperature was −16.75°, and on the 16th it was −17.5°. These were the lowest temperatures recorded this year to the present date. The 10th was the coldest day, the usual mean of the three regular observations being −7.08°.

A comparison of temperature observations of the last few years for January and February may be of interest:

	JANUARY.			FEBRUARY.		
Year	Min.	Max.	Mean.	Min.	Max.	Mean.
1881 . . .	−11.5°	44 °	16.9°	− 6 °	46°	23.0°
1882 . . .	8.0°	50.0°	30.6°	9 °	68°	39.2°
1883 . . .	−21.0°	47 °	17.8°	−21.0°	68°	25.7°
1884 . . .	−22.0°	59 °	99.7°	− 5.0°	67°	28.8°
1885 . . .	−14.5	65 °	17.2°			

If February continues cold for the next seven days these two months in the present winter will be the coldest of the past five years. The extreme low temperatures of 1883 and 1884 have not been reached, but the below zero days have been more numerous, and the mean temperature lower.

THERMOMETERS.

The severity of the past winter has invested thermometers with an unwonted interest, and it may not be unprofitable, at least to younger readers, to devote a short time to a discussion of the various kinds in most ordinary use.

As the expansion and contraction of the substance in the thermometer-tube indicates the amount of heat or cold prevailing, the definition of heat as a very rapid reciprocal motion of the small particles or molecules of matter is very appropriate, for heat expands all bodies, probably by producing more commotion among and causing their molecules to occupy a larger space. Liquids expand more than solids in proportion to the heat applied, and hence are ordinarily used rather than solids for thermometrical purposes; though some of the latter are probably more accurate and delicate, but less adapted to the more common uses of the instrument. Thermometers are based upon the facts that heat expands substances and that the same substance always possesses the same volume at a given temperature. Hence the liquid within the thermometer-tube should increase in volume to a much greater extent than the substance of the tube itself; otherwise it would not rise, but merely fill the expanded tube as before the heat was applied. Mercury and alcohol are the liquids used in the thermometers of the present day. In earlier times the air-thermometer was used, but of course was very unreliable as a heat measurer.

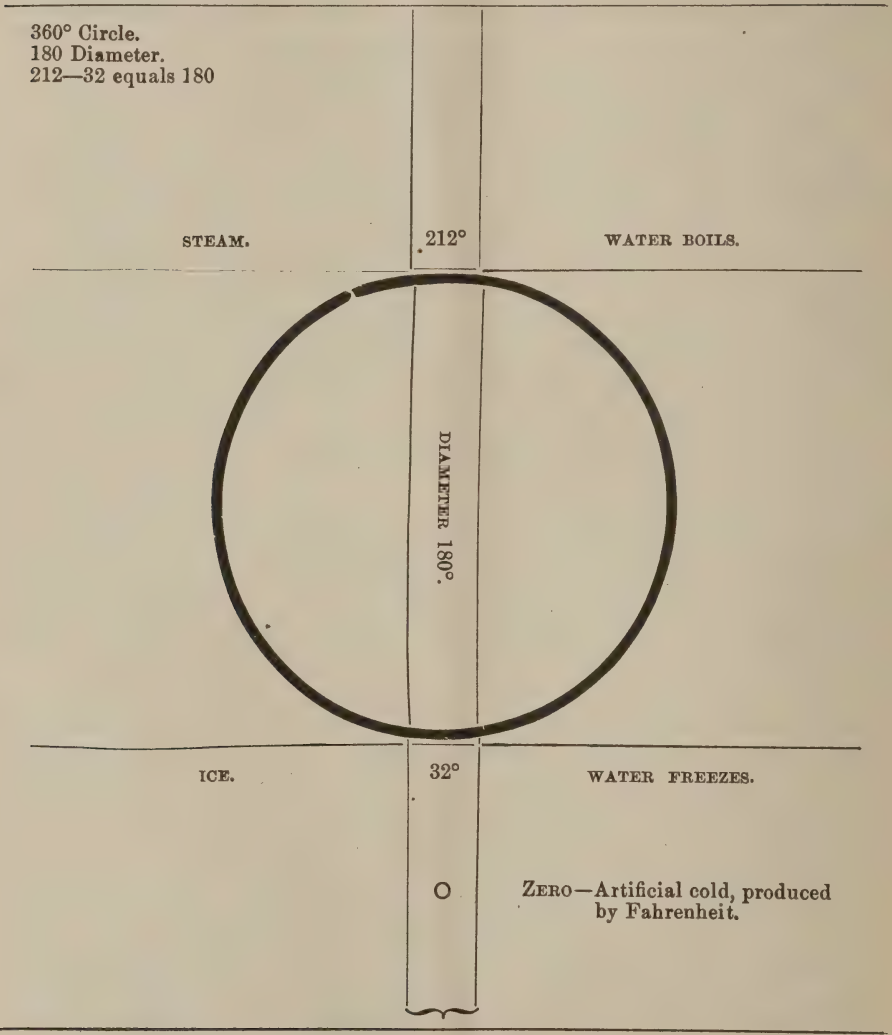
The thermometer was invented in the 17th century, and is attributed variously

to Galileo, Sanctorius of Italy, Drebbel of Holland, and to Robert Fludd. It seems probable that Galileo invented it—i. e. the air-thermometer—about 1602, for Castelli in 1638 says that Galileo had shown him one more than thirty-five years before. It was of glass, with a bulb "about as large as a hen's egg and a neck two palms long, and as narrow as a straw." A rude form of the liquid thermometer was invented in 1655 or 1656 by the members of the Florentine Academy, which possessed the advantage over the former of being hermetically sealed and not being affected by the pressure of the atmosphere. Edmund Halley, the English astronomer, introduced mercury in place of alcohol in 1680, though some writers give the credit of this use to Reaumur.

The scale of degrees fixed by the Florentines had for its fixed points the cold of snow on ice, and the greatest heat known at Florence, both rather variable points. Von Guericke, an experimental philosopher of Magdeburg, Germany, was the first to propose the freezing point of water as the lower limit of the scale, and Isaac Newton seems first to have discovered or made use of the facts that a thermometer placed in melting ice always indicates the same temperature and boiling water, when under a given atmospheric pressure, always has an invariable temperature. These points have been universally adopted by thermometer-makers as being most nearly invariable and the most convenient in practice. To find the freezing point, the bulb and tube are immersed in melting pounded ice or snow to nearly the height to which such cold will lower the column, until both mercury and glass are brought to the freezing temperature—the contraction of both thus being secured—and this point is marked on the glass. Inasmuch as water boils at various temperatures, dependent upon atmospheric pressure, purity of the water, the kind of vessel used and the state of the surface of the water, it has been found more accurate to take the temperature of the steam arising, which does not vary with these conditions. Accordingly the tube is held in the steam arising from boiling water at an atmospheric pressure of 29.92 until both glass and mercury are at the same temperature, when the point indicated is also marked.

Having secured these two fixed points, the graduation of the instrument is easy. The principal scales in use are Centigrade, Reaumur and Fahrenheit, the first having been proposed about the year 1741 by Celsus, who took the freezing point as the zero and the boiling point as 100°. This scale is most commonly used by scientists, especially in Europe. Reaumur established his zero at the freezing point and 80° as the boiling point. His thermometer is much used in Germany. Fahrenheit fixed upon 32° as his freezing point and 212° as that of boiling water, placing his zero at 32° below the freezing point. Various reasons are assigned for these differences in the scales. None, however, has been offered for that of Reaumur. As to that of the Centigrade, it is stated that according to the historical notes contained in the meteorological observations of Lafou, President of the Meteorological Commission of Lyons, the first thermometer ever seen there was exhibited in 1736 by Duhamel. This thermometer was constructed with alcohol according to the scale of Reaumur. Christin, a member of

the Lyons Academy substituted mercury for the alcohol, introducing a quantity whose volume might be represented by 6600 at the temperature of freezing water. Having raised this to the temperature of boiling water he found the volume of the mercury increased to 6700, or 100 parts. This suggested the division of the tube between these fixed points into 100°; and this, according to this authority, was the origin of the Centigrade thermometer; although as before stated, its invention is generally credited to Celsus about six years later.



Fahrenheit kept the reason for his graduation of the thermometer a secret, and it has been supposed that his zero point, 32° below freezing, was the lowest

artificial temperature he was able to produce, or perhaps the lowest natural temperature observed by him in Iceland, but recently a novel explanation has been published by an anonymous writer in the Ohio State *Journal*, which is described and illustrated as follows:

Fahrenheit was a mathematician and knew that a circle was divided into 360°. He found that steam and ice were the most natural fixed points in temperature, at opposite poles. He therefore naturally divided the distance on his glass tube between ice and steam into the number of degrees in the diameter of a circle, which is 180°. He wanted an instrument which could be cheaply made and which would measure above steam and below ice, so far as would be commonly used in everyday life. He found that artificial cold could be produced which would cause the mercury to fall just thirty-two of the spaces he had marked off on his glass between ice and steam, and he there, whether sensibly or not, placed his zero or point from which he would count. Hence ice, or freezing, is 32° above, and steam or boiling water is the diameter of his circle, or 180° above ice, or 212° above zero. This may appear very *novel and ingenious*, but its utter absurity is apparent when we remember that the diameter of a circle is not 180°. We only refer to it here because we have seen it prominently copied in respecta- and influential newspapers.

In converting degrees of one thermometric scale into those of another the following formulæ may be used:

Centigrade Degrees	$\div 5 \times 9$	$+ 32$	$=$	Fahrenheit Degrees.
Reaumur "	$\div 4 \times 9$	" 32	$=$	" "
Fahrenheit "	$- 32 \div 9 \times 5$		$=$	Centigrade "
" "	$- 32 \div 9 \times 4$		$=$	Reaumur "
Centigrade "	$\div 5 \times 4$		$=$	" "
Reaumur "	$\div 4 \times 5$		$=$	Centigrade "

Mercury expands quite regularly between —36° and 212° F. Above 212° the expansion is less regular and the indications less exact. As mercury boils at 660° F., the limit of the scale in this direction is sufficient, but since it freezes at —38° F., alcoholic thermometers must be used for lower temperatures, for this liquid has never been frozen.

Thermometers for maximum and minimum temperatures have been invented by several persons. They are self-registering, and this is effected by a small index within the tube which moves with the mercury in one direction and not in the other.

BIOGRAPHY.

PROFESSOR BENJAMIN SILLIMAN, JR.

H. E. SADLER.

The death, on January 14th, of Prof. Benj. Silliman, "Young Ben" as he had not ceased to be called though he died in his sixty-ninth year, has not been chronicled in the dispatches of the western press. This was, perhaps, to be expected, for Prof. Silliman was in no sense a leader of scientific thought. He had hit upon no such discoveries as those by which Henry opened the way for the telegraph or by which Bell has produced the telephone. He had not pushed speculation to the limit of human reason. He had not been the founder of any school of philosophy. Even in his chosen field of chemistry it has fallen to his colleagues, to Cooke, to Gibbs, to Lawrence Smith, to extend the written laws of nature and make the broader generalizations.

And yet who is left behind to whom the cause of science in America is more indebted? While acting as assistant to his father, so early as 1842, when there were yet no schools of science in this country and when even in our best colleges such instruction was given only by lectures, he fitted up a laboratory at his own expense and gathered about him a few earnest students in physical science. The dinginess of the "old lab" on the Yale campus, whose unloveliness associations have hallowed, and the atmosphere of the college green, supersaturated with Greek, would have stifled a less vigorous shoot, but after five years this bud of promise struggled forth into light and blossomed. In 1847 the Corporation named Tutor Silliman "Professor of chemistry applied to the arts," organized the Yale Scientific School, enrolled his students on the college catalogue, and appointed one of them, the lamented Jno. P. Norton, professor of Agricultural Chemistry. No longer quite single-handed, but still without other than his private resources, he engaged and equipped a larger building and made room for the students who came flocking in, zealous in the new departure. And of them all, how many drew from his untiring enthusiasm the elements of their success; the genius of hard work, the love of learning and of truth, the ambition to contribute to the world's store of knowledge, the spirit of research? How many, too, of those early disciples have continued in the paths then taken, not without reward to themselves and gain to us all. Samuel W. Johnston, Brewer, the lamented Norton, Geo. K. Brush, Daniel C. Gilman, such are the names these memories recall.

An educational revival of this character could not wait long for recognition and support. Under the skillful management of Prof. Silliman, endowments came in quick succession, and when he was called to Louisville University this

offspring of his heart and labors had, by the benefactions of Sheffield, been placed on the high road to prosperity. Immediately other scientific schools, technological institutes, and industrial colleges, began to follow in the lead, until to-day we see them scattered as widely as our common schools.

Yet this was not all, for Prof. Silliman continued a teacher to the end; nor should we forget that physicists like George F. Barker were his pupils, that naturalists like Marsh own his guidance, and that through his influence, perhaps more than any other's, the munificence of the great philanthropist laid deeply the foundations of the Peabody Museum, with its already startling achievements.

But others, whose evidence is not hearsay, are telling more vividly the story of the debt we owe him. After all, lighting the fires of that educational revolution of the fifties was not furnishing the fuel, nor could the momentum of the new engine on the highway of learning be maintained by projecting into it the Nortons and the Gilmans. Science was yet to be popularized and the *raison d'être* of technology must appear.

Probably no chemist in America has so often acted as consulting expert. New and great industries, like petroleum, have arisen at his bidding and everywhere experiment and waste have dwindled at his command. Besides the early applications of science with which his name is linked, and the reports upon matters referred to his committee by the National Government during the war, I recall, among a multitude of others in recent years, laborious investigations upon water-gas for illumination and fuel, upon the purification of coal-gas, upon marbleized or granite iron-ware, upon the fitness for industrial purposes of the water supply of towns, and upon the burning of bagasse and other wet fuels. This but hints at the variety of his studies and the range of his association with men of affairs. It is to works like these that we must look for the continuation of the liberal support which even pure science is now receiving from the productive arts.

"To love her," said *The Tattler* of Lady Hastings, "was a liberal education." To have access to Prof. Silliman's study, was to lay the foundations of character. It was to make all lovely things seem still more lovely, to learn the worth of easy circumstances, of domestic peace, of gentle sympathy, of devotion to duty, of learning, manners, and modesty, of simplicity when fortune smiles, of unswerving fortitude when she frowns. His library was a large room, blending by ample bay window with the garden. Its stretch of floor was broken by thick and kindly rugs, by escritoire and reading desk, by map cases, easels, and quaint chairs. Its mantel over-arched a grate of flaming coal which cast a glow like the peaceful love that reigned there. Piled high around were line after line and tier after tier of scientific periodicals and books, most cherished if not sole return from half a century's devotion to the *American Journal*. The sustained and serious, but bright and cheerful, occupation of the family, the earnest but above all kindly face of the master, complete a picture such as we love to hang on memory's wall.

Although the scientific work of Prof. Silliman extended through a round fifty years, the number, variety, and laboriousness of his contributions show how systematic and incessant his labors must have been. What he has accomplished, however, will be appreciated only by those who know how manifold were his interests outside of science, by those who have learned the prodigality with which he bestowed his time upon his pupils, by those who remember his remarkable faithfulness to the humblest duties, even self imposed.

I first sought his aid when interested scientifically and financially in the new water gas manufacture. At once his own library and, through his intercession, the laboratory of the New Haven Gas Company, to which he was consulting chemist, was placed freely at my disposal and he undertook gratuitously the direction of my investigations. In sickness and health, in rain and shine, through a long year his kindly face brightened daily the doorway of that remote and inaccessible room, "just for a little encouragement, you know," as he would say when I insisted that no help would be needed to-morrow. I soon had opportunity to disabuse my mind of any suspicion that this was through partiality for me, for it became evident that all his pupils were made to feel the same privilege of trespassing on his time. Certain attorneys from New York beset him one day to give evidence in a patent case, insisting that the large interests of their client hung upon his testimony. But he answered very firmly that while he had always felt that a scientific man ought to be the servant of the people, especially of their courts, and while he would be very happy to assist in establishing the justice of their client's claims, of which he happened to be in a position to be well assured, he was yet before all things a teacher, that he had a class of six students looking to him for daily direction and advice, and that he could not consent to leave New Haven for a month yet, or until his first business was done. The court held the case open till that class had completed its course in chemistry.

There was another element of Prof. Silliman's character which contributed not a little to his influence over his pupils. From youth he had been a traveler. His work had called him into all portions of the Union, into contact with all classes of society; into the barracks of the mill hands, the cabins of the miners, the salons of the proprietors. He had studied the petroleum of Southern California, the mines of Oregon. He had written for New Orleans the first course of lectures upon agricultural chemistry ever delivered in this country. In a high social position, as representative of an old and honored family in his State, the editor of a journal, in its department, *facile princeps*, one of the original fifty of the National Academy, he had lived on terms of intimacy with the learning and the culture of the land. He had visited abroad with his father, the honored guest of the scientific societies of Europe, and in turn he had entertained at home the most distinguished representatives of learning from England and the continent. His mind, broad by cultivation and sympathetic by nature, had reaped the full benefit of these associations, and with his manners, simple indeed but at all times

easy, he was enabled to enter at once into the thoughts and hearts of his pupils and draw them in turn into his own.

So he lived, modest in demeanor, not flaunting his achievements, choosing good deeds, and pursuing steadily the path of duty. His life, his words, his works, his rewards, were a perpetual inspiration to the scientific spirit, the love of truth for truths' sake, to a zeal for research, to an eagerness to bestow upon the arts the latest results of science, to a faith that the multiplied interests of a community were one and single. Neither luxurious nor penurious in his habits he saved a modest competence and for the rest spent liberally a handsome income, an income derived not from his chosen profession, for from the founding of the Yale scientific school he too often paid his own salary, and many an earnest student can testify how freely his time, and means as well, have been forced upon his pupils. That was the use he loved to make of the dollars he received from the industries to which he had saved fortunes.

Withal, his life knew its sorrows, none deeper, I think, than the calumnies which befell him in connection with the Emma mine. It was in 1869 when the independents who afterwards started the Greely movement were decrying "Grantism" in all its forms, and calling especially for purity in politics, that a suspicious connection with that ill starred English investment was fastened upon General Schenk, our minister at St. James, and he was made the object of the most unlimited abuse. The virulence did not end with him, but Prof. Silliman was included in the scandal, the whole opposition press being free in its insinuations that his favorable report upon the property was unjustified and corrupt. In vain he courted congressional investigation and sought any opportunity for his vindication. It did not come till 1877, when the principal, Trevor W. Park, was sued by the English bond-holders. But by that time the public had lost all interest. General Schenk was no longer an issue in American politics. It was too late to erase from the popular mind the blot on the chemist's good name.

He had hardly emerged into the penumbra of this shadow, when the death of his loved wife again darkened the day. Then came sickness, financial embarrassments, the infirmities of age, thickening to the end. But under all and through all he remained the same genial and faithful worker and guide.

The attacks which embittered the last years of his revered father seem to have been more provoked and easier to have avoided than the cup of gall which was given to the son. He told me once with great feeling how the genial Emeritus arose in a meeting in which the need of men for Kansas and the cause of Free soil had been debated, and said: "It is not men we need for Kansas so much as courage to fight for the right. I will be the first to give a rifle and brace of revolvers to one who will use them in the Free soil cause; who will give another?" and a hundred voices answered "I." He had pulled the trigger of a loaded gun. Throughout the North shot the cry "a rifle for Kansas." The The New Haven colony at Wabaunsee stands to-day a monument to that inspiration. But the sequel was less fruitful of good. At once from strangers and friends, from former hosts and guests, from old pupils and colleagues, there

poured in letters so cutting, so vituperative, and so scurrilous that till his death, at the close of the war, it was found necessary to scan and sift his mail before he read it.

In many respects the son was weaker than his father; in some he was stronger. Living in and for his fellow men, he read eagerly all they said of him. He could not be saved from the bitterness of their censure. And now that he has laid down the burdens he had so nobly borne and rounded out the measure which it was permitted him to fill, let us cherish the more the lessons he has taught us, and keep warm in the hearts of men his perpetual memory.

KANSAS STATE NORMAL, January 20, 1885.

ARCHÆOLOGY.

"DID THE ROMANS COLONIZE AMERICA."

C. W. IRISH, C. E.

A labored article with the above caption appeared in the numbers of the REVIEW for September and November, 1884, Vol. VIII.

It is my purpose to examine the statements of Mr. Moore, the writer of said article, with a view to ascertain how much fact they may contain, and also what may be the value of those statements to the earnest student, who is striving, out of the meagre points in his possession, coupled with traditions and known customs of the present Indian races, to build up a theory which may account for the origin of the Red Man; at least as plausibly as we account for the origin of the White Man. That by patient study of all which we can gather, we may do so, seems probable, but then in my opinion it must be done by a more credible statement of facts and better founded arguments than has Mr. Moore advanced.

In the first place, why should we begin our study into the origin of the Indian by the enquiry of "From what far-off land came he?" It is plain, I think, that if we ignore the fact that the Indian may have begun his existence here, in the land where *we* now dwell, at the very starting point of our enquiry, we commit a serious error. But not so serious as to take up all the old myths of the Gentiles, Jews, Greeks and Romans, and those of all nations of antiquity whose tales of lost tribes and individuals have come down to us through the medium of history; and try to make those old tales, myths, and traditions true by accounting through them for the origin of the Indian races of America.

Another serious error made in such inquiries, is to assume that the Indian has lapsed into barbarism; to assume that away back in time his progenitors were cultured men, highly civilized and enlightened. How foolish the statements to the effect that "The pre-historic ruins reflect not only a high order of art but are

'founded upon pre-existent models known in old civilizations. This art displays 'a mind and hand trained in the schools of science."

How very foolish such expressions are can only be known to those who have had a chance to see such ruins. We know that the science and art of the pre-historic men of America almost wholly consisted in the manufacture of bows, arrows and spears, and implements of the rudest sort made of stone or bone. We know that his building operations in the main went no farther than the construction of rude mounds of earth, and here and there the erection of buildings of the same material, whose crude and rugged forms about as nearly approach the works of art and the buildings erected by men schooled in science, as does the humble ant-hill resemble a Greek or Roman temple.

It appears from all that I personally know of the American Indians, and have gathered from reliable sources, that they are races of men, who from the very beginning of their existence, *as* men, however distant that may be, have made but little progress in refining their pursuits, their habits and manners, or their arts and manufactures. In short, it is but little more than their form and language which distinguishes them from the brutes with which they associate. Nor does it seem that within them are the elements of progress, nor do they appear to have the power to lift themselves out of the brutish life which they have led for ages. For pre-historic implements and arms which we have been able to find, show by a comparison with the arms and implements in the hands of the Indians at the time of the discovery by Columbus, that in whatever time which may have elapsed between the advent of the Indian Adam and Eve, and the time of Columbus, be it much or little, the red man made but little improvement in anything whatever.

But to return to Mr. Moore. He says on page 237, Vol. VIII, of the REVIEW: "We consider first the most universal of the testimonies reflecting the 'Indian's origin. We say universal, for whithersoever the man wandered over 'the continent, he left behind him as a testimonial the shreds of his language. '* * * * . The most common, and at the same time the most 'ancient of the Indian appellations have been preserved. They are the river 'names of the continent." Mr. Moore here assumes that each different tribe of Indians, in whatever its language may differ from the other Indian languages in its vicinity, uses in common with all other tribes the same names for the rivers of this country. How very far from the truth this is. For, as is well known, when a dominant tribe destroys or drives out a weaker one, the dominant tribe gives its own names to the streams, hills, vales, and other landmarks conquered from the enemy, taking pains in fact to destroy all that the weaker one had set-up or named. You might just as well expect a Chinaman to intuitively name the Rhone River in German terms on a visit to it, as to expect an Indian to adopt a name in his region coined by some one else. He never does it. Again, on the same page he says: "The Indian names of our rivers belong to a period when 'one common language was known, when one dominant race ruled throughout 'the entire length and breadth of America."

Mr. Moore then proceeds by a most astounding assumption to make it ap pear that the river names of America, meaning the Indian names of our streams, are derived directly from the most ancient of known tongues, the "Semitic." I will ask how does this statement accord with his other statement, that the prehistoric man was a man schooled in science? The Semitic tongue was prehistoric, and written language greatly preceded in time anything like science or schools of science.

I pass over much that he says about the terms "Aba" and "Na" in which he gathers up everything in the shape of words beginning with the different letters of the alphabet, from A to R, and tries to make it appear that they all come from "Abana." He quotes the two river names Niagara and Missouri, and endeavors to show that they are derived from Abana, meaning in these instances "restless, rapid, rushing current, a stream or a cataract." Pausing for a moment to remark that the African river Niger received its name from the Portugese, a people whose language is derived directly from the Latin, and that Niger is not at all the native name of the river, I shall state without fear of contradiction that the names of both the Missouri and Niagara are not the Indian names of these streams, but were also given to them by those white men who were the first to see them as discoverers, and were the names of the Indian tribe which happened to dwell on the banks of each, respectively, at the time of discovery. I shall give the Indian name of one of these rivers further on. He also pretends to derive the word Mississippi from the Sanscrit, or Dacian, and says that the original word was Messis-apa. Now, Mr. Moore must possess information which no other man possesses on this point, or else he makes an unqualified misstatement, for I have before me a copy (photograph) of the map drawn by Father Hennepin, and dated 1703. His travels in conjunction with La Salle were along this river in the years 1680–3. Now Hennepin spells the Indian name of the river on this map of which I speak, in one place Meschasipi and gives the meaning Grand River, meaning literally, Great, or Big River. In another place on his map, he spells the name Mississipi. On DeLisle's map, dated 1718, it is spelled the same as last above; and lastly, Captain Carver spells it on his map, dated 1766, Mississippi, and these men were the first ones to get the name from the Indians. Any one who has a knowledge of the dialects of the Algonquin Indian languages, knows very well that the termination of the river name in question, viz: si-pi, sip-pi, se-be, (as I have seen it written in more than one instance on old maps and in writings of the past century) is nothing more than attempts to spell the word meaning river in those dialects. In order that it may be seen that I am right in this matter, I here give the different spellings of the Algonquin word meaning river, as pronounced by various bands of that widely spread nation or family of nations, among which the discoverers the Great River traveled on their way to it, and while along it, and from whom they procured the name, given above and from which comes the name we know it by. The Ojibwa of Sault Ste Marie, Se-be (pronounced See-pee). Ojibwa of Grand Traverse Bay, Se-be (pronounced See-bee). Ojibwa of Saginaw, See-bea (pronounced

See-pea. Ojibwa of Michilimackinac, See-bee (pronounced as spelled). Miami, Se-pe-we. Chippewa, Si-pi (pronounced See-pee). Other bands of the Chippewas living north of the Great Lakes pronounce it Nee-pee, the spelling of which, as I have frequently seen it, is Ni-pi.

I have made it clear, I think, that the Indian name of the Mississippi comes to us from the Ojibwa or Chippewa, and that its meaning was or is "Big River." De Soto, on reaching its banks some years before La Salle, found that the Indians in his vicinity called it "Big River," and I know that the Sioux called it in Hennepin's time, and do to-day call it, Wak-pa-ha-ha; Wak-pa meaning river, and ha-ha meaning falls, or literally River of the Falls, for its great feature in their vicinity was the Fall of St. Anthony. I further know that from St. Anthony's Fall to its mouth, the river was known to all the Indians along its banks, as the "Big River," down to its mouth, except perhaps an Illinois band who called it Mis-seek-si-pi, meaning "The Grassy River," or better "The River of the Grassy Plains." Now I would ask of Mr. Moore his authority for his rendering of the word as he has it on page 241, Messi-apa. If it is possible to twist orthography and etymology so as to derive Missis-si-pi from Aba, Aub or Ab, then all we shall need in future research of the kind, is a Latin dictionary and a Sanscrit Bible. What is the use of a knowledge of the exact meaning of the words in any language if we are to do as Mr. Moore has done in his paper? To pick out certain words in an obsolete tongue signifying whatever they may, and then culling over the thousand and one tongues spoken over the world and taking from them all words which have a like sound with our selected standard, and then assume that they also have a like meaning with the words of our standard.

That Mr. Moore has done this in his paper I affirm, nor is he alone in this matter, for many writers have fallen into the same error, but have not been willful in doing so as Mr. Moore seems to be; for when the original word has not the slightest resemblance in its pronounciation to any of his so-called "Terms," he willfully misspells it, so as to make an apparent agreement. Mr. Moore on pages 364–5, Vol. VIII, wades through a large number of names derived from, or given by Spanish explorers to rivers and places in America, to prove that the Latin word *Aqua* was as he says: "Well and thoroughly known and correctly spoken 'by the native peoples of the American continent." Now I challenge him to produce a vocabulary of a native American tongue, in which the Latin word *Aqua* occurs, or any of its forms as spoken by people of Latin origin, and at the same time meaning water. I also challenge him to find a vocabulary of a native American language in which words, if there are any, beginning with Aq, Ag, Ack, Aqu, Agu, or any other forms, having a similarity with the words Aqua, or Agua, in which the said native American words have a meaning expressive of the word water. It is plain that all the names which he quotes, and which have come to us from Spanish geographers, are words of their own invention. The Spaniards, who with their priests, of the time of the American discoveries, were noted for refusing everything native, abhorred the natives, for they were heathens, and refused them a place in their literature. Hence we know less

about native manners, customs and languages in countries of Spanish discovery, and over which they have dominated, than any other. How funny Mr. Moore's meaning as he gives it, of the river name Orinoco, is, when we know that it means in the native language of that region "Crooked River." He makes it "Orien-aqua," or "River that runs towards the sunrise." On page 367 he renders Michilimackinac, first into Mackinaw, from which he makes an easy jump into "Ma aqua-na." It is well known to every school-boy in this northwest that the work Michilimackinac was the name given to a certain island near the Straits of Mackinaw by the Chippewa Indians, and means "Turtle Island." I would ask Mr. Moore where he gets his term Aqua, meaning water, out of the above true meaning?

On page 368 he again refers to the river names Mississippi and Missouri, which I will notice in passing, to say that I have fully disposed of the origin and meaning of the first, and now assert that the last was never the Indian name of the river to which it is now applied, but was given to it by the white men who first traversed the country from its mouth westward, because the powerful tribe of Indians which they found along its valley were known by the name of Messourias, which name, now changed to Missouri, is given to the State and river. The ancient Indian name of the Missouri was Pekitanoni-si-pi, a name given to it near to its mouth, doubtless by the "Illini" Indians. I have not yet ascertained the meaning of the name, but I do know that all the tribes living along this river above Council Bluffs, call it the Big Muddy River. The Sioux call it almost universally Min-ne-sho-sha Tanka, literally water, dirty, big. Where then is the claim of Mr. Moore to rest, that the word Missouri means "the gathering river?" His statement to that effect is the purest nonsense. Equally so his statement, that the word Jehovah in any sense or form occurred in the ancient Choctaw tongue.

Now, the syllable Chuc, which Mr. Moore makes do duty for the expression Great Father, or God, has in its forms of Chi, Che, or Chu, quite a different meaning. For instance, here in Iowa we have a river, the ancient Indian name of which was Chi ca-qua-se-po. Taking his analysis for the meaning of this river name, we have Chic—God, or Father, Jehovah, aqua,—water, and as se-po means river, he would render it God's Water River, and he would go into rhapsodies over his supposed great discovery of the scolastic knowledge of the Latin tongue by the breech-clouted Indian who named this river. Now let us see what the name of this river means in the Indian tongue to which the words belong. It is Algonquin, and in that tongue Chi-ca means a stink or bad, strong smell of any kind, and as applied and modified in this instance it means Skunk, or strong stinking animal, hence the Indian name of this river rendered into English is Skunk River. Now how divine it does appear, and how scholarly the Indian must have been; "schooled in science and the Latin language," to be able to give the stream such a high-sounding title.

The word Chicago is also of Algonquin origin, and in the case of the city of ha t name means Onion, which is a strong smelling plant, and was gathered in

great quantities by the ancient aborigines along the Chicago River (Onion River) and over the marshy flats adjacent. Mr. Moore would have us believe that the name means the City of Jehovah! What a drop there is, from his Latin afflatus down to the level of Indian simplicity! On pages 370–1, Vol. VIII, Mr. Moore says: "In some of our northwestern States the term 'Minne' is often found in 'the native Indian names of waters * * * . It is 'evident that some natural fact gave birth to the expression 'Minne.' What was 'this fact? * * * Geology and physiography unfold 'their testimonies. * * * The English pioneer pushes 'into that same northwestern country and everywhere the same natural facts pre-'sent themselves, and they are marked down on our maps simply the red or the 'vermillion, and if we look into the geographical literature of the country, there 'we shall find the Great Red River (of the North), Vermillion Lake, Red Lake, 'etc. Underlying the country are vast deposits of red clay, red sandstone, and 'vermillion earth. Many of the waters there have in consequence the reddish 'tinge. * * * If we open our authorities on language 'we find in our Indian 'Minne' merely the Latin *minio*, which in plain English 'means precisely the red or the red vermillion clay. It would be difficult to find 'verbal testimonies more conclusive than in those Minnesota names. * '* * The legend says that Minne-ton-qua means 'thundering water.' 'The Latin has *tons* for thundering and the 'qua' is but an abbreviation of *aqua*. 'Minne-ha-ha reveals one of the Roman idioms, etc. In analyzing the word 'Minne-h-aha we discover a superfluous h. * * * By 'reference to authorities on the Latin language we find that the letter h is often 'an abbreviation of the word *habeo*—to hold. The word Minnehaha would 'therefore mean river that holds red or vermillion clay. The waters do hold the 'red element for a long distance."

In the above quotations we have Mr. Moore's attempt at derivation of the words Minne Tonka (not Ton-qua as he spells it,) and Minne-ha-ha. It is proper to say that these names come from the Sioux or Dakota Indian tongue. The word which signifies water in that tongue is Min-ne; it in no sense is taken to mean red. The Sioux words meaning red are Sha, or Duta, the last properly signifying scarlet. The word signifying thunder in that language is Wa-kin-yan, also the word signifying big, or great, is Ton-ka.[1] And again the words Min-ne-ha-ha signify waterfalls, ro literally, curling waters, and is always applied to waterfalls. The words Min-ne Ton-ka signify Water Big or Big Water. Here I must say that the lake so named up in Minnesota got its cognomen from Governor Ramsey of that State. Its Indian name (Sioux) was Mde Tan-ka, Lake Big, or Big Lake. There is perhaps no other State in the Union having so much lake area of pure clear water as has Minnesota, and there is not a lake, or pond, large or small, in the State which has a tinge of red in its waters, nor even so

1 The *n* in each of these words has the nasal sound of *n* in bring, and the *h* in the word ha-ha has a rude guttural sound very much like the sound one makes in hawking a fish-bone from the throat.

much as muddy water within its banks, that I can recall; and I have travelled quite extensively in Minnesota, and have noted very particularly its superficial and topographical features. The small stream which gives outlet to the waters of Lake Minne-tonka is the one which gives rise to the Falls of Minne-ha-ha, its waters falling over that cascade, and although there is an underlying bed or stratum of red clay throughout the region of the lake, and creek, and yet it does in no way give a tinge to the waters of the lake nor to its outlet stream.

It is a well attested fact that throughout the region of Dakota Territory and the States of Minnesota, Wisconsin, and Iowa, there are several underlying strata of red clay, and of red sandstones, yet in no instance known to the writer do these red materials tinge the waters red, nor are they reddish in any instance where they approximate the surface of the ground. Now this being true, what becomes of Mr. Moore's statement to the effect that the waters of this region are so tinged as to readily suggest such names as Red Lake, Red River, etc? The Sioux words Minne-ha-ha signify waterfalls, not "water holding red clay." The Sioux words signifying Red Water River are Wak-pa (river), Minne (water), Sha (red); Minne always signifies water in that language. Then how can this word come from, or be derived from the Latin word *minio?* (red). The Sioux word Ton-ka signifies big or great. How then can it be derived from the Latin word *tons* (thundering), and again, if Governor Ramsey invented the name of the lake, using two Indian words which signify Water Big, or Big Water, how, I ask, is Mr. Moore to derive it from the Latin to thunder, thundering, etc.? It is plain, I think, from all that I have discussed of Mr. Moore's paper, that he is entirely wrong in his statements of fact, and in his deductions. He evidently believes that all the Indian languages of the western continent are but dialects of one original mother tongue, a belief very far from the truth. Fortunately for the archæologist, the Indian tongues come to him in their purity, not having that dilution of terms and phrases which characterized the languages of the eastern continent centuries before an attempt to systematically study them was made. I will say here that not only Mr. Moore, but many others, have been greatly misled in attempts to study and to account for the peculiarities of Indian languages, manners, and customs, by the assumption in the outset, that not only the human family, but all spoken languages, have had the same point of origin. Of these students Mr. Moore shoots the widest of the mark. For if he has either willfully or unwittingly made the misstatements and errors in regard to words belonging to the Sioux or Dakota, and the Algonquin languages, as I have pointed out, then we must believe that he has been equally faulty in his investigations into the meaning of all the words which he quotes from the various American Indian tongues in his paper.

I therefore come to the conclusion that as far as Mr. Moore's researches are concerned, we have no reliable proof that any known Indian language has been derived from the Latin, or in fact from any other known tongue of the Eastern Hemisphere, and I further conclude for the same reasons that the Romans *did not* colonize America.

Iowa City, Iowa, February, 1885.

CAVE AND CLIFF DWELLINGS OF ARIZONA.

REV. ISAAC T. GOODNOW.

Nine o'clock in the morning found us at Flag Staff, 344 miles from Albuquerque. By previous arrangement, Major J. C. Minor, land agent of the Atlantic and Pacific Railroad, soon appeared with his fine span of mules and in a rapid drive of twelve miles southeasterly, through woods and dales, soon brought us to Walnut Cañon, the site of the wonderful Cliff dwellings. With hardly any warning we approached it from a nearly level plain. Emerging from the pine woods which surrounded it, we suddenly found ourselves upon the brink of a deep chasm, said by Major Minor to be 1,000 feet deep, and perhaps of the same average width, though quite irregular. The sides consist of ledges of gray limestone, forming on each side of the cañon a succession of huge steps to the bottom, leaving room for a small stream of water. These layers of rock are perhaps from five to fifteen feet thick. Half way down, some of these ledges are overhanging, from six to twelve feet; the base rock having been crumbled or worn away, possibly in part dug out, leaving a space between the upper and lower ledge from six to twelve feet wide and from five to eight feet high. Here we find the cliff dwellings. The roof, floor, and back side of each dwelling is formed by nature, and it only remains for the inhabitant to build the front side and the ends. This was done with stone plastered together with mud, leaving a low doorway to crawl through. In front of the line of dwellings, nearly at the outer edge of the ledge, is a narrow roadway, or foot path, by which each one could reach his residence. These dwellings in some instances we found in two lines, one above the other, and in one case I found a third, but very short line. I made a personal examination of some thirty-five dwellings, some larger and some smaller, according to the space between the rocks. Major Minor estimates the whole number at 400; extending up and down the cañon five miles. Reckoning five persons to a family, it would give a population of 2,000 inhabitants. Near by among the pines we found fragments of pottery, plain and ornamented. The burial place for their dead has not yet been found, though diligently sought for by Major Minor, who some two years since discovered the dwellings; who inhabited them is a matter of conjecture. They must have preceded the present race of Indians who know nothing about them. And the problem is as much of a mystery to them as to us. One thing I have omitted to notice; approaching from the north—the cañon extending east and west—we struck it exactly opposite a high peninsula connected with the north side, half way down the cañon, by a low isthmus. This peninsula forms a partial division between the eastern and western portions of the cañon that come under our immediate inspection, and must command a fine view of both. I was limited in time and did not ascend to the top, though I examined the dwellings below on

its west side. The Major says the top was occupied as a fort. Certainly no finer site could be chosen. Thus ended our first day's work. On the second day, it being decided that the mountain of the cave-dwellers would be too difficult for Mrs. G. to climb, Major Minor very kindly invited Mr. Thomas and his nearest neighbor, Esquire Hicks, to accompany us. Our road led along the railroad track east several miles and then to the northeast up a beautiful valley, interspersed with handsome pines. We passed on our right a detached volcanic mountain with crater still extant, 300 feet across its southern rim, partly worn away. To the left upon a slight knoll in the timber, was a fort evidently to command the southern approach to the caves.

At the distance of eight miles from Flagg Staff, and I guess twelve miles in a northeasterly direction from the cliff-dwellings, we found ourselves at the base of a steep hill 700 feet high. This forms the southern extremity of a range of volcanic foot hills of the San Francisco Mountains. Ascending the hill at an angle of 45°, its face being covered with powdered lava thrown from the caves near the summit, we found it pretty hard work, as each step upward was sure to give way downward! The crust of this mountain was originally in a molten state, which gradually consolidated into a tufaceous rock, tough and hard. To form a dwelling place, a circular hole was made into the ground, probably to the bottom of what would constitute the floor of the principal room, and it was then rounded out into an oval or circular form, from ten to twenty feet in diameter and from five and a half to seven feet in height, leaving a sufficient thickness overhead to make a strong roof. Out of the main room some two or three other rooms extended; serving probably as sleeping or store rooms. In some cases a room was excavated much lower than the large room, probably answering the purpose of a cellar. Generally the dwellings had no connection with each other, but in some cases they had. At the top and southern brow of the hill was a fort with a part of the walls standing, some three feet thick. It extended east and west across the hill some sixty feet, evidently designed to defend the approach from the northern ridge, which is about on the same level. As a general thing these caves were arranged in parallel and semi-circles, commencing at the top of the hill at the south end just below the fort, and extending down the sides of the mountain, the lower circles being the longest. The entrances to the caves in some cases were near the middle and must have been by ladders, in other cases near one side, and might have been by stairs. Around many of the openings were circular walls, evidently constructed to guard against accidents or as a defense against an enemy. In some of these caves, well away from day light, were beds evidently used by bears or wild animals. As part of the time my explorations were by myself and beyond the hearing of my companions, even with a shout, the query did arise, while poking around with a long stick in the low, dark cellars, what would happen should I find Old Bruin at home? What gave special emphasis to such an enquiry was the fact that my only weapon of defense was a stick. After such reflection my stay in dark passages was not prolonged!

One of the largest caves was near the top by the fort and is supposed to have

been occupied by the head chief. It is thought there was originally an underground connection between this and the fort. If so, the passage-way has been filled and obliterated. Evidently rude and unfriendly hands have left the marks of destruction upon these unique dwelling places. The mouths of many have been completely stopped with large stones, others partially so. The conquerors did their best to render this city of the cave-dwellers uninhabitable. Major Minor, the original discoverer, three years since, estimates the number of the caves at 200. A more beautiful prospect as seen from this town site cannot well be found. East, west, north and south, mountain ranges clad with snow 7,300 feet high, intervening valleys, and detached knobs are commingled in a way to produce one of the most delightful landscapes in the world!

By an article in the March number of the KANSAS CITY REVIEW, I see that another village of the cliff-dwellers has been discovered; it is also situated on a volcanic foot-hill of the San Francisco Range, and is some fifteen miles from the cliff-dwellings of Walnut Cañon. It numbers sixty-five dwellings. The entrance to each is by a perpendicular square hole or shaft, extending from the surface to the floor of the main room at one side. Foot holes cut at convenient distances on the sides of the shaft, served as a stairway. A groove fifteen inches wide and eighteen inches deep, extended from the floor of the main room up one side of the shaft to the surface of the hill. Ashes at the bottom of the groove and the blackened sides above marked the fire-place and the chimney of the dwelling. In the cave-dwellings which I visited, the fire was built on one side of the large room and the smoke was left to find its way out of the circular opening wherever it was. We found fine specimens of broken pottery, plain and ornamental, with the metatas, or hand corn-mills, of the inhabitants, but nothing which would give us any insight as to the tools used in excavating the dwellings. On the other hand, in the interesting article referred to, mention is made of stone mauls and axes used in doing the work, with ornamental pottery, corn-mills, bone awls and needles of delicate workmanship, shell and obsidian ornaments, and implements of wood, the uses of which are unknown. Mr. Stevenson found evidences that satisfied him that the inhabitants here held communication with the cliff-dwellers in Walnut Cañon, but does not say what they are.

The preservation of wooden implements in these underground rooms, where they have lain for centuries with other relics undisturbed, demonstrates with marked distinctness the wonderful dry and preservative qualities of the atmosphere of this strange country. People here ought to live one hundred and fifty years.

We were particularly fortunate in our guide. In his antiquarian researches he is indefatigable and remarkably successful. One year since, at the great bend of the Colorado, seventy miles north, he found the ruins of a great city, extending along the banks of the river for ten miles. It was originally buried in sand after the fashion of some Egyptian cities, and afterwards brought to light again by the winds blowing from a different direction. The dwellings are of stone, two stories high, plastered with mud, similar to the cliff-dwellings. Major

Minor was successful in his search for their cemetery and procured specimens of pottery, etc., with all the skeletons, or remains of skeletons, he wished.

Mr. A. M. Sanford called my attention to the existence of a detached mountain of almost pure salt, situated on the Colorado River, 160 miles north of Kingman; ninety-five per cent chloride of sodium, and five per cent alumina. It is transparent like glass and print can be read through a mass a foot thick! The supply is inexhaustible and eventually must become a source of great profit. Mrs. Goodnow has specimens of pottery from the cliff and cave-dwellings and the newly discovered city, which can be seen by any one having a curiosity. While those from the last-named city exhibits most skill, there is a striking resemblance that assures one that the original inhabitants of all these towns were of the same nationality. In their building operations they adapted themselves to the peculiar features of that portion of the country in which they lived. Arizona in truth is a wonderland! We know comparatively little about it. If the little exploration already made, brings to light so many mineralogical, geological and ethnological curiosities and marvels, what may we expect when fully examined and carefully studied by the scientific travelers of the world?—*Manhattan (Kan.) Republic.*

GEOLOGY.

RAMBLES OF A NATURALIST AROUND KANSAS CITY.—III.

WM. H. R. LYKINS.

One day I sat upon an eminence overlooking the vast fertile plains of Kansas. It was a lovely day in October. A mellow, golden haze filled the air, softening the outlines of other hills which rose in the distance like the bold headlands of a sea coast. In the valley below were cozy farm houses embowered in the variegated foliage of fruit trees, and far away as the eye could reach lay yellow fields rich with the ripened fruit of the husbandman's labor. Herds and flocks pastured upon green meadows, and everywhere were men moving about like busy ants intent upon garnering their winter stores.

It was a perfect picture of the peace, prosperity and contentment of man. "It is, indeed, beautiful," said a voice echoing my thoughts, and turning I saw —or thought I saw,—standing beside me an aged man with a long, yellow beard leaning upon a ragged staff, and, like myself, contemplating the lovely landscape. "It is, indeed, beautiful," said he, "but it was not always thus. Listen!" he continued with sudden energy, "listen and I will tell you how it was. Ages upon ages ago I stood upon this spot. It was early morning and a hot mist obscured the view, but I could hear strange animal sounds, roaring, growling, snarl-

ing, hissing, and startling screams as if all the menageries of the world had been turned loose in this place, and, as the mist cleared away I saw a wonderful scene. Before me lay a vast lake, or inland sea, stretching far away to the north, bordered by a rolling country of rich savannahs and tropical forests, watered by many streams and rivulets, all teeming with animal life. Over the broad valleys roamed herds of elephants, the strange-tusked and triple-horned *Dinoceras*, and many other equally wonderful forms. In the forests monstrous beasts, the *Hadrosaurs*, half-bird, half-serpent, moved sluggishly, feeding on the lofty tree-tops. On the waters of the lake great turtles lay like floating islets; on the rocky reefs sea-serpents an hundred feet in length reared their crested heads and hissed at each other in horrid combat. In the shallows waded gigantic toothed birds like *Hesperornis*, while overhead the leathery-winged *Pterodactyls*—veritable flying dragons—fought in mid-air over their prey, uttering those piercing screams I had heard. By the water-side is feeding a herd of the peaceful *Oreodon*—that curious compound of the hog, deer and camel,—when a pair of ferocious *Drepanodon* or saber-toothed tiger dashes upon them, rending and slaying in the very wantonness of their brutal strength and power. Man, if indeed he has yet appeared upon the earth, has fled far from these savage scenes and sought refuge in the recesses of the mountains whose cold, blue peaks glimmered faintly on the western horizon. It was the *Age of Monsters*.

"Another age had passed away when I returned to this place. How changed the scene! One vast sheet of ice covered all the land. Nor bird, nor beast was to be seen; what few animals had survived the cold had fled far southward. The sun hung low in the southern sky, giving forth a pale and sickly light destitute of heat. An awful silence brooded over the scene, broken only by an occasional moaning, creaking sound as if Mother Earth was groaning in agony underneath the great monster that lay upon her breast. It was the *Age of Ice*.

"After another age, again I returned. As at the first time it was early morning and the sun had not risen, but through the gloom I could see advancing across the plain what appeared to be a monstrous serpent, roaring and hissing as it dragged its jointed length along, a single eye blazing in its forehead, shedding forth a baneful light. Surely, thought I, the Age of Monsters has returned again, but what monster is this, more terrible than any I have yet seen, which seems to devour the very earth before it! But as the sun rose and the light increased, I saw before me cultivated fields, happy homes, towns and cities, churches and school houses, and railway trains—even as you see it now. It was the *Age of Man*."

"Who are you?" I exclaimed in astonishment, turning to look at my companion again, but he had vanished, and I saw only in his place a bunch of the tall wild Sun-flowers, their yellow heads nodding gracefully to the soft southern wind which murmured musically through their leaves. I had been dreaming of the past, the present,—What will the *Future Age* be when this has passed away?

TERTIARY IN HARPER COUNTY, KANSAS.

F. W. CRAGIN.

EDITOR REVIEW:—If you have space for it yet in this issue of the REVIEW, I show like to record the fact that the tertiary in Kansas south of the Arkansas River can at last be definitely asserted to occur as far east as Harper County. A fossil presented to me from that county by Mr. C. D. Moore, and which was found at a depth of fifteen or twenty feet in digging a well, proves to be the large metatarsal of a Tertiary (probably Pliocene) horse. The fossil has been submitted to Prof. Cope, of Philadelphia, who states that it belongs to a type of horse different from any hitherto known, in having the lateral metatarsals (splints) more closely approximated than usual and *extremely unusual.*

I now refer to the Tertiary, also the conglomerate bed resting upon the Dakota sandstone near the east line of Barbour County. It is from this conglomerate and its former continuation eastward that the streams in that vicinity derive their beautiful array of colored quartz pebbles, and which, owing to its position—lower, as regards actual elevation, than are certain Dakota and all the Niobrara formations in Barbour and Comanche Counties—I formerly referred to the Cretaceous.

The pebble and gravel beds (largely white quartz) of Kingman County and southern Reno, are doubtless to be referred to the Tertiary also.

These developments indicate not only the absence of the Benton and Niobrara in Harper County, but also that the Tertiary is, in Harper County, brought down to within an unusually short distance of the Permian, following and immediately overlying the Dakota nearly to its eastern limit.

ASTRONOMY.

SUN AND PLANETS FOR MARCH, 1885.

W. DAWSON, SPICELAND, IND.

The Sun moves eastward about two hours, or 30°, every month. On March 1st its R. A. will be 22h. 51m.; declination 7° 19′ S. And on the 19th it completes the whole round of 24h., or 360°; passing the Vernal Equinox about 7:00 P. M., Kansas City time, that day. It also crosses the Ecliptic to the north, and by noon, March 31st, has a northern declination of 4° 25′, and R. A. oh. 41m. March is often called a Spring month but, astronomically, Spring season

does not begin till the Sun reaches the Vernal Equinox. Spots on the Sun are larger and more numerous in February, to date (17th), than in January.

There will be an eclipse of the Sun March 16th, visible here as a partial eclipse; beginning soon after 10:00 A. M., and ending near 1:00 P. M. The Moon will be so far from the Earth that it will appear smaller than the Sun, and the eclipse will be annular, i. e. where it is central the outer edge of the Sun will be visible like a bright ring around the black Moon.

The path of central eclipse will strike the United States about 150 miles north to northwest of San Francisco; pass northeasterly into British America; cross Hudson's Bay and Greenland; leaving the Earth near 200 miles north of Iceland. There will also be an eclipse of the Moon, March 30th, about 10:00 A. M., and, of course, not visible here. But it may be seen on the opposite side of the Earth, nearly from Pole to Pole. For table of eclipses see REVIEW for August, 1883.

Jupiter and Saturn are now grand objects for evening observation. Saturn crosses the meridian soon after 6:00 P. M. in the early part of the month, and is inconveniently high for observation till 8:00 or 9:00, when it will have descended to a good position. The ring will continue at its widest phase with little variation for several months. Jupiter is a diamond beauty in the eastern sky; rising on the 1st, at 4:44 P. M. and southing about 11:30. Mercury is in conjunction March 13th, and will hardly be visible during the month. Mars is just passing conjunction, and will not be visible for some time. Venus is still a Morning Star near the horizon. It is declining northward and crosses the equinoctial March 31st, when it rises exactly east, half an hour before sunrise. Uranus comes to opposition on the 21st, when its R. A. is 12h. 5m., and declination 0° 21′ N.; being very near Eta, Virginus, and still nearer a small fixed star to the southwest. Neptune is still about where it has been for several months, a few degrees southwest of Pleiades.

THE ECLIPSE OF THE SUN OF MARCH, 16TH

PROF. W. W. ALEXANDER.

On March 16th, 1885, there will be an annular eclipse of the Sun, visible at Kansas City as a partial eclipse. The elements are as follows, by "Central Standard Time":

Conjunction in Right Ascension 12h. 14m. 23.6s.
Sun and Moon's Right Ascension 23h. 46m. 35.35s.
Sun's hourly motion 9.13s.; Moon's, 126.07s.
Sun's declination 1° 27′ 12.0″ South.
Moon's declination 0° 39′ 11.0″ South.
Sun's parallax 8.9″; Moon's, 57′ 7.7″.

From these elements may be deduced the following results: Central eclipse begins at sunrise, in the Pacific Ocean, about one thousand miles west of San Francisco; from this point it will sweep in a northeasterly direction; leaving the ocean it will enter the United States in Latitude 40° North, and cross the northern part of California and Nevada, passing over the great Salt Lake of Utah, and through the center of Wyoming and Dakota Territories. It will encounter British America and pass over Lake Winnepeg. Hudson's Bay, and Greenland, and continuing on in the same line, it leaves the Earth at sunset in the Atlantic Ocean about four hundred miles east of Greenland.

As seen from Kansas City the Moon will pass too far north to cover the Sun; so we will get only a partial eclipse, the northern limb and a little over half of his diameter being covered at the time of central eclipse, 11h. 55m. A. M.

The time of first contact or beginning of the eclipse here will be 10h. 30m. A. M., and on the northwest edge of the Sun is where it will first appear. Last contact, or end, will be at 1h. 20m. P. M., and on the northeast edge of the Sun.

In eclipses of the Sun we see no visible effects of umbra and penumbra on the Sun itself. We have the real (though invisible) Moon eating into the real and visible Sun, and along the line named above, there would have been a total covering or hiding of the Sun by the Moon, if its apparent size had not happened to be less than that of the Sun at the time of central eclipse.

To explain this I must give a few figures. As both Sun and Moon are round, or nearly so, the shadow from the latter ends in a point. The shape of the shadow, is in fact, that of a cone, hence the term "cone of shadow." Now, the length of this cone varies with the Moon's distance from the Sun. When nearest, the Moon will of course throw the shortest shadow. The lengths are as follows: when the Sun and Moon are nearest together 230,000 miles, when farthest apart 238,000 miles. The distance from the Earth to the Moon also varies as follows: when nearest together 225,000 miles, when farthest apart 251,000 miles. Hence, when the Moon is farthest from the Earth, or in apogee, the shadow thrown by the Moon is not long enough to reach to the Earth. At such times the Moon looks smaller than the Sun, and if she be at node we shall have an annular eclipse—that is, there will be a ring (*annulus*, Lat., ring) of the Sun visible around the Moon when the eclipse would otherwise have been total.

The most simple way to protect the eyes in watching an eclipse is to use a plain piece of glass smoked over a coal-oil lamp until it is sufficiently dark to obscure the glare of the Sun.

EDUCATION.

DIFFICULTIES IN SEARCHING FOR TRUTH.

PROF. S. H. TROWBRIDGE.

There is no end of theories upon all questions now vexing the public mind, —whether scientific, theological, social, political, or what not,—and he who cannot find among this maze of wisdom and unwisdom, plausibility and absurdity, a a doctrine to please him must be very hard to suit. The chief trouble is, the majority are pleased with too many of them. No mountebank can proclaim views so wild and absurd as to be without followers. Most men allow others to think for them. They simply absorb like a sponge, and, like it, as readily give up what they have taken in when squeezed a little by the next theorist. The "people" who "do not consider," and who "are destroyed for lack of knowledge," are as universal as the human race, and the persistence of this trait has not less weight than some others urged in proving that the race is one. They who live "to tell or to hear some new thing" are not dead yet, and do not all live in Athens.

But a doctrine is not to be condemned because it is new, or to receive unquestioning acceptance because it is old. The Ptolemaic system of astronomy was fully believed in for a score of centuries, and afterwards found to be fallacious; and we know not how many accepted theories of the present day will be swept away with the advancing floods of intellectual progress. The question of a true philosopher is not whether the doctrine is musty and discolored with age, or is young and untried as the new-born babe; but whether *it is true.*

A most important desideratum to an investigator is a disposition to see both and all sides of a question with equal candor. An unbiased mind, which searches *alone* for *truth,* is the only one qualified to investigate with success or safety. If one begins with preconceived opinions, he is almost sure to become a special pleader in favor of the notions he most desires to establish. With a theory to prove, especially if he has expressed it with any considerable positiveness, he must have virtue almost super-human to give equal weight to arguments for and against it. Men are naturally so averse to any intimation that *they* have ever made a mistake, or failed to see through and through a thing at first sight, that a change of views is, to many, a confession of weakness or ignorance. Owing to this prevailing weakness of human nature,—which is a far more serious malady than the fallibility it is designed to conceal,—it is extremely wise to withhold any positive expression of opinion upon a debatable or much debated question upon which one wishes to reach the highest truth. Of course, one must have a work-

ing *hypothesis*, and some theories to *test;* but this is far different from having a position to *maintain* at all hazards.

Another serious obstacle to the search for truth is that men are too apt to accept the "confident assertions and well-put arguments" of popular writers and speakers without inquiry, when these accord with the views they wish to believe. The merest charlatan has only to say his opinions are based upon those of some "distinguished investigator,"—whose name he is very careful not to mention,—to give his assertions the full weight, in the minds of many, of a naturalist or statesman, a theologian or philosopher, who has exhausted his subject in original and painstaking research. We have ample illustration of this sort of special pleading and of the suicidal popular craving for it, (without mentioning numerous others) in the criminal distortions of the teachings of both nature and Scripture in the interests of infidelity, and the hardly less criminal ignorance of these things in the interest of religion. It is sadly humiliating to see those whose professions would argue clearer discrimination, grasping at untenable theories because they are fancied to establish notions one wishes to maintain, or positions supposed to be essential. This state of things is largely due to the popular willingness to be imposed upon and the vicious cramming system of ordinary school instruction; both tending to the destruction of independent thought.

While this practice of running wildly after every new theory is pernicious in its effects upon the legitimate investigations of our times, the fact that great changes in sentiment and practice are yet to be looked for should not be ignored. There are, doubtless, phenomena continually exhibited all about us which we do not even perceive, much less understand, but which it is the office of independent thought to discover, investigate, and explain. That revolutions are yet to take place, the rotten foundations of our present political fabrics but too clearly indicate. Bickerings and jealousies in the church show that it must have yet other reformations. And the arbitrary laws of popular custom need to be completely revolutionized. Lack of the habit of observation, tenacious adhesion to party and precedent, selfishness, and fear of violating the exactions of society, are the obstacles here. Undue conservatism tends no less to lock the wheels of intellectual progress than excessive fanaticism.

The bull-dog method of convincing an audience or an individual is another fruitful source of evil. There are intellectual highwaymen who *assert* with such positiveness their unsubstantiated tenets,—as if annihilation, total and immediate, would be the price of non-acceptance,—that ordinary minds tacitly assent, on the principle that discretion is the better part of valor. They are simply overpowered, not convinced. When one in the form and fashion of a man, with commanding impudence thunders out, either in word or in substance, "you are wrong, sir, and I am right, and you are a fool if you don't admit it," I yield to him as I would a bandit with a loaded pistol at my head, and with very much the same feeling toward him. He has by brute force suppressed all expression of opinion from any who would not be as ill-mannered as himself; but has not forced from a thinking hearer the reserved right to hold views sustained by the

latter's own reason and judgment. Too many are, by these intellectual mastiffs, completely frightened out of all future claim of right to their own opinion, on the very erroneous supposition that what is so positively asserted must be true. On the contrary, the more carefully and honestly one has examined all phases of a much-disputed question, the more of truth does he see on both sides, and the more hesitancy he feels in positively pronouncing his convictions: whereas, he who has seen only one side is thoroughly convinced (like the negro judge, who could decide best before the arguments for the defense had confused him) that the case is so clear already that further argument is superfluous. So true is this that, perhaps, no better rule can be given for estimating the value of an author's statements on mooted topics than this: the weight of his opinion is in inverse ratio to the positiveness with which he asserts it.

The field in which a single individual can be an absolutely *original* investigator, is a very narrow one. No *one* can examine *all* the facts bearing upon any important subject of discussion. All are, therefore, compelled to take on trust, to a greater or less extent, the observations and often the interpretations of others. With the severest scrutiny and most scrupulous care, this is often hazardous and misleading. No two persons see exactly alike, even when both have sight and judgment in normal condition. Each observer sees a different rainbow, and even the two eyes of the same observer, as in a stereoscopic view, see different phases of the same object. Such physical defects as near-sightedness or color-blindness of which often the individual himself is not aware, may materially modify the appearance of things he has carefully examined. Moreover, one's powers of discrimination are liable, often unconsciously, to be warped by personal interest or by prevailing opinions and habits of thought, and, through ignorance of this fact, far too high an estimate may be placed upon the results attained by him. Again, with perfectly normal vision, and totally free from mental bias in any direction, one may fall far short of the soundest conclusions through *lack of training* in observation, comparison, and judgment. The conclusions of a novice should not be graded with those of a trained investigator. He may be possessed of equal powers by nature, but has not learned to use them with equal discrimination and effect. Nor does it follow, because one is an adept in a single line of effort, that he is equally trustworthy in every or in *any* other. The old truth, taught by Æsop, that nature does not confer every good upon one, is too often forgotten. An authority in theology, for instance, is not necessarily an expert in science or philosophy. That he is necessarily *not* an expert in these would, doubtless, from the nature of the case, be equally true. So, high official position, or even eminent success in certain directions, often carries with it, in the judgment of the masses, an authority far above its real value. Advancement in position or circumstances may be due to brass, selfishness, favoritism, or accident, and not to real worth.

These considerations and many others are too often overlooked or ignored in reaching conclusions. To weigh correctly the stated results of every investigator, it is necessary to have his personal equation, or error, as carefully deter-

mined and as clearly expressed as that of an astronomical observer; and to have all the helps and hindrances to his work, tending to modify his results, estimated with the same vigorous discrimination. Except, perhaps, in the line of mathematics, we have no *means* of doing this, because we have no fixed standard of comparison as in the heavenly bodies and in the direct proofs possible to mathematical reasoning. In other lines, the nearest to accuracy we can reach is in the careful balancing of probabilities. In this, too, the personal liabilities to error are involved, and thus the conclusions of erring men, even with equal honesty and candor, are necessarily subject to infinite variation.

Another difficulty in arriving at truth, growing out of our necessary dependence for data upon the researches and statements of others, is in the liability to miscomprehend the facts as stated. If an author's statements are written, by the simple oversight of a comma his words may convey a widely different meaning from that he intended. The mistake of a little girl who protested that there would be plenty of preserves to eat in heaven, because the catechism says, "He makes, preserves, and keeps them;" and the pessimist's quotation, "There is a divinity that shapes our ends rough, hew them how we will;" are not without a parallel in many a more profound research. When statements are taken from oral delivery, it is easy to fall into an error like that of the little girl who, on returning from Sunday School, asked her mother what kind of a bear a consecrated cross-eyed bear was. She had heard them sing, "The Consecrated Cross I'll Bear." Another, who had heard repeated the golden text: "Behold! a greater than Solomon is here," said on returning home that the text was, "Hold a grater to Solomon's ear." Men are often charged with statements which are equally foreign to their real sentiments. This may be due to no lack of honesty but to lack of good hearing or of discrimination.

In too many other cases, however, it is nothing but sheer dishonesty. Even men in high positions are not infrequently detected in garbling quotations from more original authorities, coloring their extracts to favor their own views and positions, when the real meaning of the author quoted is entirely different. Lorenzo Dow's text from the Bible, "Top-not come down," (Matt. 24, 17), for a sermon against the coal-hod bonnets of his day; the wag's rendition of Scripture, "The wicked flea, when no man pursueth but the righteous, is as bold as a lion," are not a whit further from the truth intended than many of these mutilated quotations.

It is not particularly assuring to one who wishes to keep a general run of the best thought and work of the age, and must take it largely at second-hand, to be engulfed in such a chaos of deception and contradiction as the following, which is not an imaginary case: One reads an article by a not unknown writer, setting forth views pleasing to the reader and such as he would gladly accept. He notes them as of peculiar interest. Coming to "editorial notes" in the same issue, he finds expressions of doubt as to their correctness. In a latter issue the reader is reassured by a rejoinder in which the criticised author maintains his position "without fear of successful contradiction" by a long array of instances, and fortifies it with copious quotations from the writings of known and trusted

investigators in that special field, and names many others who accept his conclusions "with very slight, if any, qualification." The disappointment of the student is bitter when, on further reading he finds that two independent critics almost annihilate an authority upon which the first author had most largely depended for support in his position. This authority had inserted and omitted words in a direct quotation from a still earlier author which gave the latter's words an opposite meaning; and had given great weight to the views of another, himself "known to be very unreliable as an authority." In another publication, the student finds the original defendant further discomfited, and his own confusion increased, by reading that the paper of the defendant's main authority, while dubbed "very able" and "forcible" by one reviewer, is said by another to be "remarkable for its erroneous statements and its misapprehension of facts," and "still more remarkable when we consider its assumptions for what it does not contain." Still another authority, quoted by both the defendant and his right-hand man as of great weight, was shown by yet another critic to have retracted the very statement quoted and confessed he was misinformed. In view of the inherent difficulties in the way of a satisfactory solution of the many deep questions which vex the thinking world, it is immensely important that these difficulties be not wantonly multiplied by parties who warp truth and insinuate error in dishonest attempts to establish their own positions.

GLASGOW, MO., February, 1885.

BOOK NOTICES.

ORIGINAL RESEARCHES IN MINERALOGY AND CHEMISTRY: By J. Lawrence Smith, M. D. Octavo, pp. 630. Edited by J. B. Marvin, B. S., M. D., Louisville, Ky., 1884.

This handsome volume, as stated in the February number of the REVIEW, was prepared at the request of Mrs. Smith as a testimonial of her esteem and as a memorial book for presentation to Professor Smith's scientific friends and relatives. Dr. Marvin has devoted much well spent time to its preparation, and the publishers have put it forth in elegant and substantial form.

Professor Smith was essentially an original investigator, and, from his student days to the end of his life, labored earnestly and diligently as a skilled explorer in the several fields of chemistry, mineralogy and physiology. He had hosts of friends among the learned scientists of this country and Europe, and received honors from nearly all of the scientific associations on both sides of the Atlantic. Besides the biographical sketch of his life by Dr. Marvin, prepared by request for the American Academy of Arts and Sciences of Boston, another was written for Year Book of the City of Charleston, S. C., by Middleton Michel, M. D., and

still a third for the National Academy of Sciences by the late Professor B. Silliman. In fact, one of the last literary labors of Professor Silliman was the preparation of this memoir to his old friend and colleague, and almost his last energies were given to directing the completion of the medal which is, through the liberality of Mrs. Smith, his devoted widow, to be presented to discoverers in the study of meteoric bodies as the "J. Lawrence Smith Medal."

Beginning life as a civil engineer, he devoted himself earnestly to acquiring a complete knowledge of his profession, but finding it not altogether to his taste he abandoned it and studied medicine, giving six years to it in the best schools of this country and Europe. Returning home at the age of twenty-six, he commenced lecturing in the medical college at Charleston. From that time forth he was a teacher; a portion of the time in the University of Virginia and afterwards in the University of Louisville. He was appointed at the age of twenty-eight, at the request of the Sultan of Turkey, to teach the agriculturalists of that country in cotton culture, and was subsequently made a government mining engineer by the Sultan, in which position he was so serviceable to that country that he was honored with numerous decorations and costly presents.

His researches in chemistry and mineralogy were published from time to time in *Silliman's Journal*, the *American Chemist*, *Cosmos*, the Proceedings of the American Association, etc., as well as in several of the principal French and German scientific periodicals of the day, and were regarded as valuable contributions to knowledge. His collection of meteorites is one of the most extensive in the world, and he was an acknowledged authority on this subject.

His original researches number about one hundred and fifty, while his lectures, addresses, scientific and secular papers amount to many more than this. Aside from his professional labors of all kinds, his life abounded in beneficent acts, and he was able to say at its close, "Life has been very sweet to me. It comforts me. How I pity those to whom memory brings no pleasure."

GEOLOGICAL EXCURSIONS, OR THE RUDIMENTS OF GEOLOGY FOR YOUNG LEARNERS: Alexander Winchell, LL. D. 12mo., pp. 234. Illustrated. S. C. Griggs & Co., Chicago, 1884. For sale by M. H. Dickinson, $1.50.

Of all of Dr. Winchell's works this simple book for children is likely to accomplish the most good, from the fact that it begins at the right place,—in virgin soil—so to speak; where there is nothing to be unlearned and where the good seed will take firm root and bring forth good fruit. The teaching of geology is usually postponed until "college days" and there the whole science is crowded into a few months at the rate of about two lectures a week and—at least in our own case—without specimens or practical field illustration. Every man remembers his youthful collections of "petrified wasps' nests," "funny stones," etc., and how easy it would have been to have crystallized his enthusiastic interest and admiration into actual practical knowledge at that time, whereas in most

instances he knows as little now as then of geology, notwithstanding his subsequent "course" in college.

Dr. Winchell, in this text-book takes the pupil in this impressible stage of life and by means of illustrations from the garden, the field, the gravel bank, the laboratory, in the marble yard, by the water side, in the gorge, at the rocky ledge, etc., familiarizes even the youngest pupil with the various kinds of rocks, gravels, and clays of, which the crust of the earth is formed. He then takes excursions to the White Mountains to examine the Eozoic rocks; to the Upper Mississippi to examine the Cambrian formation; to Niagara Falls to learn the history of the Silurian; to Mackinac for the Devonian; to Burlington, Iowa, for the Lower Carboniferous; to Selma, Alabama, for the Mesozoic rocks; to Claiborne, Alabama, for the Tertiary formations, to the river valleys for the Quartenary; to Switzerland for Glaciers, and finally, through the Ages for a comprehensive history of the plants and animals of the past.

Much use is also made of maps in training the learner, objectively, to proper conceptions of superposition, succession, continuity and other phenomena of the stratified rocks.

At the end of each chapter "Exercises," consisting of questions upon the previous statements and subjects growing out of them, are found, which is an admirable feature of the work, since it tends to keep the pupil thinking for himself and not permitting him to depend solely upon his text-book.

As a text-book for beginners in the study of Geology—and they cannot begin much too early—this is the best work we have ever seen, and the advantage of it is that any teacher can teach it without previous knowledge of the subject.

CONDITIONS OF MENTAL DEVELOPMENT, AND OTHER ESSAYS: By Wm. Kingdom Clifford, F.R.S. Price 15 cents, post-free. J. Fitzgerald, New York, 1885.

This volume forms No. 65 of the *Library of Popular Science*. Besides the essay on Mental Development, it contains three other essays by the same distinguished author, namely, "The Aims and Instruments of Scientific Thought;" "Atoms;" and "The First and Last Catastrophe." Prof. Clifford stood in the foremost rank of scientific philosophers, and the essays here published are among his most elaborate productions. They are now for the first time offered at such a price as to bring them within the reach of all.

SCHOOL KEEPING. HOW TO DO IT: By Hiram Orcutt, LL. D. 16mo., pp. 248. New England Publishing Co., Boston, 1885. For sale by M. H. Dickinson; Cloth $1.00.

The design of Dr. Orcutt in publishing this work is to aid and encourage those who need and would profit by the experience of others and to awaken an interest among other classes as well as teachers in the subjects treated.

It is divided into seven chapters: "Theory and Practice," in which the theory is reduced to practice; "How to Begin" with patrons and pupils; "How to Govern" one's self as well as one's pupils; "How to Teach," "Physical Culture," with a supplemental manual of gymnastics; "Morals and Manners," "Temperance in Schools," with a treatise upon Physiology and Hygiene.

The work is practically a rehearsal of many of the scenes and much of the work of the author's school-life, and is a result of his long experience and observation as a teacher. It should be extensively read by teachers and those interested in the subject of teaching.

SYSTEMATIC MINERAL RECORD: Edward M. Shepard, A. M. Octavo, pp. 98. A. S. Barnes & Co., N. Y., 1884. For sale by M. H. Dickinson.

This little book has been published by Professor Shepard, after four years use of it in his classes at Drury College, as a means of training the student to habits of observation and correct methods of reasoning in the department of determinative mineralogy. It consists of blank forms for the description of any given mineral, with all of its physical and optical characteristics, and also for its chemical properties. On the reverse side of each of these blank forms are spaces for noting its associated minerals and any other points of interest connected with it.

Preceding these schedules are some twenty pages of explanatory text, defining minerals and explaining their physical properties and chemical characters, with their peculiar characteristics under each of these heads, such as touch, specific gravity, structure, hardness, cleavage, magnetism, odor, taste, solubility, assaying tests, as fusibility, color-flame, etc.

All the terms and chemical reactions used in describing minerals are given and explained, also lists of chemicals and apparatus most needed in blow-pipe analyses, with the names of minerals suggested as a foundation for a term's work in mineralogy with laboratory practice, and a full list of the most important works on mineralogy with prices, when known.

It is probably the most complete work of the kind in print and will be found exceedingly useful to both professors and students.

RURAL TASTE By G. M. Kern. Octavo, pp. 141. Herald Printing House, Columbia, Mo., 1884. For sale by M. H. Dickinson; 75c.

The object of the author is to explain the principles of the art of landscape gardening and the cultivation of rural taste in western towns and country districts. Mr. Kern is a practical landscape gardener of long experience, thoroughly educated, and an artist in his line. He has had charge of the leading parks of St. Louis, and his effort in this book is to make such work a branch of education. Professor Fleet, of the State University, endorses him and his objects in the

most flattering terms, and commends this book to the teachers of the country as worthy of their adoption as a text-book in their schools.

It is divided into three parts, viz: Matters of Taste, under which head he treats of principles of art, principles of taste, floral taste, etc. Secondly, Matters of Art, such as the art of design, ornamental gardening as an art of design, the study of nature, first principles of association, study in landscape gardening, etc. Thirdly, Matters of Fact, under which he discusses correct judgment, home gounds, public improvements, grounds of institutions of education, and the burying ground.

The work is written in graceful style and the subject is presented logically and impressively. No one can read it without being convinced that Mr. Kern is master of the subject and that his thoughts are worthy of careful attention and general adoption.

OTHER PUBLICATIONS RECEIVED.

Meteorology of the Mountains and Plains of North America, an address before the Cattle-Growers' Convention at St. Louis, by Silas Bent, St. Louis, Mo.; E. P. Studley & Co., printers. *Annals of Mathematics*, edited by Ormond Stone and Wm. M. Thornton, Office of publication University of Virginia, Vol. I, No. 4, Charlottesville, Va. Trumbull, Reynolds & Allen's Annual for 1885, Kansas City, Mo. *Journal of New York Microscopical Society*, edited by Benjamin Braman, Vol. I, No. 1, New York; $1.00 per year. *Journal of Mycology*, edited by W. A. Kellerman, Ph.D., and assisted by J. B. Ellis and B. M. Everhart, Manhattan, Kansas, January, 1885, Vol. I, No. 1; $1.00 per year, 15c. a number. Supplemental report of the Railroad Commission of Tennessee, by John H. Savage, Nashville, Tenn., Albert B. Tavel, printer. *The Iowa Historical Record*, published by State Historical Society at Iowa City, January, 1885, Vol. I, No. 1. Water Purification for Steam Boilers and Laundry Purposes, William Tweeddale, Topeka, Kansas. *The Canadian Science Monthly*, No 1, Vol. III, Wolfville, N. S. *The Humboldt Library*, No. 65, price 15c.; Conditions of Mental Development and other essays, by Wm. K. Clifford, J. Fitzgerald, Publisher, N. Y. United States Consular Reports: Labor in Europe, Letter from the Secretary of State; Washington Government Printing Office, 1885. Circulars of Information of the Bureau of Education, No. 7, 1885: Aims and Methods of the Teaching of Physics, by Professor Charles K. Mead, Washington, D. C. Prix-Courant, d' une Choix de Graines, spicialement recommandables pour, 1885, Monsieur le Director La Compagnie Continentale d' Horticulture Gand (Belgique). Columbus, Ohio: Its Commerce, Industries and Resources of 1885, published by the Columbus Board of Trade. Early Migrations, Arctic Shifts and Ocean Currents, by Charles Wolcott Brooks, San Francisco, California, 1884. *The Auk*, Vol. II, No. 1, January, 1885, Boston, Mass., Estes & Laureat; $3.00 a year, 75c. a number; edited by J. A. Allen, Cambridge, Mass. Department of Interior,

Building for the Children in the South, Washington Government Printing Office. Report for the year 1883–4, presented by Board of Managers of Observatory to the President and Fellows of Yale College.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

PRODUCTION OF INODOROUS COAL OIL.—This process especially contemplates the treatment of refined oil, the object being to thoroughly remove all traces of the original odor from the kerosene.

To this end the invention consists in employing induced currents of air as a vehicle for carrying away a portion of the odorous impurities in the liquid, and of neutralizing or destroying a further portion of such impurities by the action of sulphuric ether, and while changing the color of the product, in neutralizing the remaining impurities by the addition of a coloring compound and a mixture for imparting fragrance.

In the procedure of carrying out the invention the kerosene is located in a suitable tank where it is acted upon and thoroughly agitated for the period of four hours, or thereabouts, by currents of ordinary atmosphere induced by any suitable air-pumping apparatus connected to the said tank.

When a certain quantity of sulphuric ether (about one drachm to each gallon) is added to the product while in the tank, and thoroughly incorporated therewith by the action of the air-currents which are again supplied as before stated and continued for the period of about ten minutes.

The color of the product so formed may now be manipulated to any desired shade by adding to each fifty gallons a mixture consisting of one ounce of aniline (any color) and twelve ounces of linseed oil.

The addition of this coloring mixture not only changes the color of the product but a portion of the remaining impurities are neutralized thereby.

To still further and completely destroy any remaining trace of odorous impurity that may adhere to the product, and, at the same time to impart a pleasing fragrance thereto, a mixture consisting of one ounce of oil of almonds (or any other fragrant extract oil,) and one ounce of sulphuric ether is added to each fifty gallons of product.

The above described process has been patented by Mr. Leon Blumenthal, of Kansas City.

IMPROVED TUBULAR WELL.—The object of this invention is to provide tube-

wells with such improved water-lifting devices as will render their construction and repair more certain of accomplishment, and their operation comparatively more reliable than heretofore.

It has been found in practice that, owing to the nature of the ground through which the greater number of tube-wells are bored, the cylinder corrodes so as to be within a short time almost or entirely unfit for service.

In order to remedy this defect it is proposed to galvanize the cylinder both internally and upon its outer surface.

Heretofore much difficulty was had in driving check-valves to their seat at the lower extremity of the cylinder or driving-barrel. As there was practically nothing connected to them that would keep them in a vertical line with the cylinder, they would, as it were, attempt to turn end for end, and in many cases would come to and be left upon their bearing in an oblique position.

A check-valve under such circumstances could not fully accomplish the object which its name implies. An improved check-tube is closely encircled near its lower end by a turned ring which has a diameter corresponding to the bore of cylinder.

When the check-tube is being driven to place the drill-rod is attached to its upper end and a rubber packing-ring having a plain outer surface, guides the upper end, and the turned ring holds the lower end in a central position.

The said packing-ring has a flaring internal surface, and it is expanded by a correspondingly tapered cone upon the check-tube. Each of these parts is constructed with smooth surfaces for reasons explained further on.

The check-tube can only be driven downwardly until the coned surface comes in contact with a beveled seat flared from the internal diameter of the turned ring at its upper edge.

Heretofore, owing to the absence of such a seat to limit its movement, the check-tube has been driven so far within the packing-ring that the latter would interfere with the perfect working of the valve, and the packing-ring (usually rectangular in cross-section) would be compressed until when required its removal would be very difficult if not impossible.

The smooth surfaces of the improved cone and the comparatively small body of rubber forming the packing-ring render the withdrawal of the check-tube quite an easy matter. When the check-tube has been fully driven to place, the lower edge of the packing-ring is in contact with the upper edge of the turned ring.

An internally threaded thimble is attached to the lower extremity of the check-tube and prevents the same from being drawn upwardly without carrying with it the turned ring. This latter is secured internally at its lower end forming a concentric shoulder which is engaged by the upper edge of the thimble.

The lower edge of the turned ring or follower rests upon the top edge of the sand-point coupling. This coupling has an external diameter corresponding to the cylinder.bore and its lower edge rests upon a concentric shoulder projecting

within the driving-shoe, and the upper end of the said point is attached to the sand-point coupling, as shown.

Mr. F. H. Smith, of this city, is the inventor.

COMBINED CARPET-MOULDING AND FASTENER.—Mr. Isaac Holzmark, of Kansas City, has produced a new design for ornamental carpet-mouldings of which the following is a brief description. Heretofore fastenings for carpets that were in the form of mouldings, or strips, have been constructed without regard to ornamental outlines—that is, the edge of the strips were in most cases undisturbed, straight lines.

The principal feature of the design is a series of ornamental wings projecting from one side of the moulding and terminating with apexial extremities. Circular spaces separate the said projecting wings from each other, and triangular apertures upon a direct line with the edge of the strip and at a uniform distance therefrom form a part of the wings and impart to them a comparatively artistic and finished form.

The moulding is provided with teeth or claws upon its under surface, for engaging the carpet, and thumb-screws that are easily operated secure the moulding to the floor.

KANSAS CANE AND SUGAR ASSOCIATION.

PROF. E. H. S. BAILEY, KANSAS UNIVERSITY.

At the annual meeting of this Association, held in Topeka on February 5th, a committee was appointed to urge the passage of the bill now pending before the Legislature to foster the sorghum cane industry by the payment of one and one-half cents per pound upon all sugars above a certain grade made in the State. Mr. E. B. Cowgill, U. S. Commissioner for the sugar industry in Kansas, gave an encouraging account of his experiments on keeping canes in Silo. The canes were laid in windrows and covered with about six feet of soil. Analysis frequently made showed that the proportion of sucrose diminished but slightly, while that of glucose increased. There is great hope entertained that by thus keeping the canes the working season at the factories may be doubled. A method of evaporation by hot air was discussed in a paper by Mr. A. A. Denton. Prof. Failyer urged the necessity of greater economy in methods of extracting the juice. By present methods only about three-fifths of the available sugar is obtained. It is possible that in the diffusion process lies the solution of this problem. The sugar content of the cane may probably be largely increased by careful and judicious cultivation. Mr. Bennyworth proposed that the canes be steamed before going through the second pair of rolls. As far as his experiments had progressed this process was a great improvement. Mr. Parkinson suggested that as the seed of the sorghum contained so much starch all manufacturers should

utilize it as a source of glucose. Prof. Bailey read a paper upon the relative values of different sugars. From his experiments glucose has six-tenths the sweetening power of cane sugar. Prof. Scoville discussed the early history of the beet sugar industry, and drew important lessons of encouragement for Kansas cane growers. Prof. Swenson, also a superintendent of sugar works in the State, reviewed the reverses and successes of the business, and predicted that it would prove eventually a financial success. Unfortunately the recent fall in the price of sugar had left no margin for profits; they were in a much better position to make good cheap sugar than a year ago.

EDITORIAL NOTES.

THE severity of the past winter at this point may be seen by reference to the following table, showing the number of days in each month when the mercury reached zero, or below:

1884.	7 A. M.	2 P. M.	10 P. M.
Dec. 22	– 2	5	5
" 24	– 5	0	– 2
" 25	– 3	7	5
" 31	1	7	0
1885.			
Jan. 1	– 8	5	3
" 2		15	20
" 16	– 1	0	– 5
" 17	–10	5	6
" 18	– 1	5	2
" 19	– 3	4	3
" 20	– 3	16	10
" 21	– 3	– 2	– 6
" 22	– 8	13	20
Feb. 9	7	4	– 7
" 10	–16	– 7	– 1
" 16	–10	7	8
" 18	– 2	14	13
" 20	– 7	9	9

S. B. HILL, of Stockton, N. J., writes: "I am glad you continued to send the REVIEW for I think it the best periodical of the kind that I know of. I inclose $2.50 to pay for it another year."

MR. JOHN P. JONES, the archæologist, writes Feb. 10th, "Enclosed find $2.50 for the REVIEW. Glad you keep it going. I take most of the journals published in the United States of a kindred nature and do not find any that affords more satisfactory reading than yours.

DR. D. G. BRINTON, of Philadelphia, has in press the fifth volume of his series of "Aboriginal American Literature," entitled "The Lenâpé and their Legends." It will present the full original text and all the symbols or pictographs, 184 in number, of *Walum Olum*, or Red Score of the Delawares and has never been published before. Cloth, $3.00.

THE accomplished Librarian of Congress, A. R. Spofford, asks for back numbers of the REVIEW that he may have the volumes bound for preservation in that library.

THE State Normal School of Kansas, at Emporia, was founded in 1865. Its endowment fund is $182,331.40; annual income about $16,500. Total enrollment in 1878–9, 80. Total enrollment in 1883–4, 534. The total enrollment in 1884–5 will be much larger. It is strictly a Teachers' Training School, and offers excellent facilities for special preparation for the active duties of the profession.

PROF. C. F. CHANDLER, of the School of of Mines, Columbia College, New York City, editor of *The Photographic Bulletin*, which

commenced a new series with January, 1885, proposes to make it the organ for the interchange of ideas among scientific men and others interested in photography on the subject of photographing in natural colors. He desires correspondence on this subject, reports of phenomena that may have come under the observation of artists and others in this connection and suggestions as to the direction in which investigations should be pushed

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of this Country and Europe, at a discount of from* 15 *to* 20 *per cent off the retail price.*

WE find the *Atlantic Monthly* for March an unusually spirited number. Dr. Holmes definitely opens his "New Portfolio," which is exceedingly engaging. Beside the three serials by Mrs. Oliphant, Miss Jewett, and Mr. Craddock, there are several papers which are of value to thoughftul readers. The chief of these is a sketch by Clara Barnes Martin, called "The Mother of Turgeneff," which gives a strikingly vivid but not altogether pleasing picture of Russian home-life fifty years ago. Two scholarly articles, "Time in Shakespeare's Comedies," by Henry A. Clapp, and "The Consolidation of the Colonies," by Brooks Adams, an almost painfully realistic story by Bishop, called "The Brown-Stone Boy," and a delightful Mexican travel paper, with the grateful title of "A Plunge into Summer," by Sylvester Baxter, complete the longer articles of the number. The usual careful book reviews and short notices, together with the Contributors' Club close this attractive issue. Houghton, Mifflin & Co., Boston.

OUR former references to the high character of *Education* as an able educational magazine are fully sustained by its January-February number. Supt. Long, of St. Louis, discusses "Intellectual Training in Normal Schools," and Prest. Hunter, of the New York City Normal School, the "Necessity and Growth of Normal Schools." Prof. Anderson, of Aberdeen, Scotland, writes of "The Æsthetic Element in Education," and Mrs. Hopkins treats of "The Memory Faculty," in her course in Psychology. Prest. Bicknell's Annual Address before the National Educational Association at Madison, appears in full. Other articles are "The Lost Atlantis," by Mrs. Knight; "Quintilian's Educational Theory," and Foreign Notes. This number is embellished by a steel engraving of Louis Prang, the celebrated art publisher of Boston.

This magazine should be read by all thoughtful teachers and parents, as it embodies the best literature of the teaching profession. Price $4.00; single copies, 75 cents.

WHEN a new drama has proved successful, it is customary for the audience to call the author before the curtain. They have a curiosity to see what sort of man it is that created the play that has amused and instructed them. There is something very much like this in regard to our great newspapers; their editorial utterances are all anonymous, but there is generally a tradition of some half-shadowy personage who has established the journal, given it its character, and constantly directs it; and the public like to have him come before the curtain now and them, to address them in his own person. This Murat Halstead, of the Cincinnati *Commercial Gazette*, has done in the March number of the *North American Review*, to which he contributes an article on "The Revival of Sectionalism." In the same number, Archdeacon Farrar presents his views on "Future Retribution," and Prof. N. K. Davis discusses "The Moral Aspects of Vivisection" in a way that brings together briefly nearly everything that any person of note has said on the subject. Max Müller describes the astonishing ideas of the Buddhists on the subject of Charity, and George John Romanes opens up a great subject wi h an article on "Mind in Men and Animals." The other articles are one by President Gilman on Titles (chiefly scholastic), one by Judge John A. Jameson on "Speculation in Politics," and one by John W. Johnston on "Railway Land-Grants."

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Possession of the beds, personal supervision of the work, several years experience, and special interest in the subject, enable me to furnish *specimens unequalled in perfection and beauty.* In removing the matrix the fossils are preserved in their natural position upon blocks of the rock in which they are imbedded, and in most cases, *are as perfect as when fiast fossilized.* By this method the specimens are beautifully mounted. and present an attractive appearance.

In making excavations, slabs of shale are sometimes found containing *remarkable clusters of Crinoids* and their associate fossils. *These are of special interest* and are preserved with great care. In preparing them for the cabinet, the matrix is so removed as to leave the fossils *embossed upon the slabs in as perfect condition, and in the same relative position* in which they were buried in the bottom of the sea. These slabs are exceedingly interesting illustrations of natural history as written in the rocks of the Carboniferous Period.

We solicit corresponce with, and orders from all parties interested in making collections, either public or private. Every collection should contain some of these rare and interesting specimens. All institutions of learning especially need them as illustrations of Natural History. And they are beautiful and interesting ornaments for the mantel or center-table.

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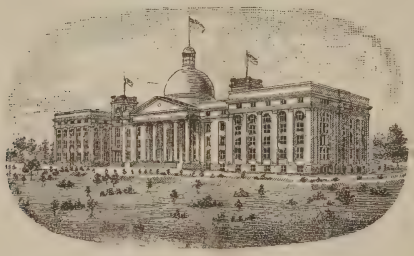
PROF. D. A. BASSETT,

CRAWFORDSVILLE, - IND.

UNIVERSITY

—OF—

MISSOURI,



COLUMBIA, - MO.

The Academic, Agricultural, Normal and Engineering Schools will open the 2d Monday (8th) of September, 1884. The Law and Medical Schools will also open September 8th.

THE DEPARTMENTS OF INSTRUCTION ARE:

1. The Academic Schools of Language and Science.

2. The Professional Schools of Agriculture, Pedagogics, Engineering, Art, Law and Medicine, and at Rolla, the School of Mines and Metallurgy.

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TABLE OF CONTENTS.

PAGE.

PHYSIOLOGY.

1. The New Phrenology.* Dr. J. B. Browning, ... 669
2. Where does Consciousness reside? . 677

GEOLOGY AND MINERALOGY

1. Some Geological and Topographical features of Southern Kansas.* Prof. F. W. Cragin 668
2. Mineral Belts of the Continent . . . 682
3. West Virginia's Tin Mines 684
4. The Mexican Tin Fields 684

PHYSICS.

1. Electricity and Magnetism.* Prof. F. E. Nipher 685
2. Fatigue of Metals 689

HISTORY.

1. A Paper on New Mexico.* Mrs. Flora Ellice Stevens 690
2. The United States in 1780, 1880 and 1980.* E. A. Hickman 694
3. The Renaissance in Italy 697

ASTRONOMY.

1. Certain Spots on the Sun, What were they?* Dr. Louis Watson 699
2. Notes on same.* Prof. C. W. Pritchett 700
3. The Sun and Planets, for April, 1885.* Wm. Dawson 702
4. Recent Astronomical Discoveries . 703

ARCHÆOLOGY.

1. Prehistoric man in Egypt and Syria 703
2. Use of Copper Implements by the American Aborigines 705

METEOROLOGY.

1. The Kansas Weather Service.* Prof. J. T. Lovewell 708

PAGE.

ENGINEERING.

1. The Nicaragua Canal 709

MEDICINE AND HYGIENE.

1. The Origin and Spread of Cholera . 711
2. Prevention of Cholera 713

BOOK NOTICES.

1. Creator and Creation. Ivison Blakeman. Taylor & Co. 717
2. Chapters on Evolution. G. P. Putnam's Sons. 718
3. Approaching End of the Age. A. C. Armstrong & Sons 718
4. The Theistic Conception of the World. Harper & Brothers 719
5. Wonders and Curiosities of the Railway. S. C. Griggs & Co. 720
6. Medical Electricity. Fowler & Wells 720
7. Technical Education and other essays. J. Fitzgerald & Co. 720
8. Other Publications Received 721

SCIENTIFIC MISCELLANY.

1. Recently Patented Improvements.* J. C. Higdon, M. E. 722
2. The St. Louis Academy of Science . 723
3. A Study of American Wheats 714
4. Exploring Alaska 725
5. Coal-Dust in Colliery Explosions . . 726
6. The Permanency of Wrought-Iron Structures 727
7. Sanitation in St. Louis 729

EDITORIAL NOTES 730

ITEMS FROM PERIODICALS 731

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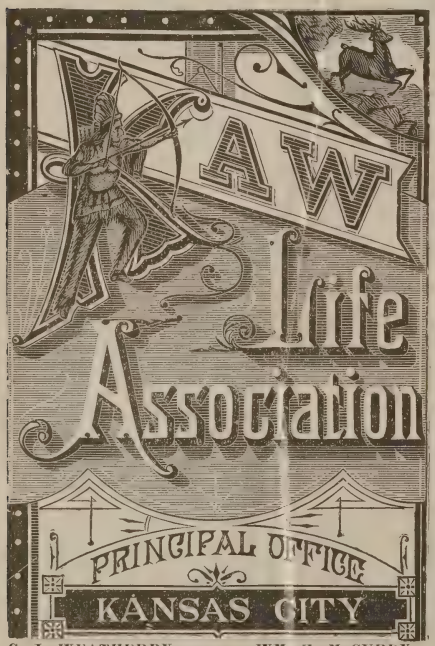
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INDEX.

Academy of Science, Kansas, Seventh Annual Meeting of.....454
Academy of Science, Kansas City 120
Academy of Science, Iowa State 150
Academy of Science, St. Louis 406, 723
Age of the World 570
Age of Steel, Creators of 251
Alaska, Exploration of.....725
Alexander, W. W., Eclipse of the Sun of March 16th 653
American Association for the Advancement of Science.....287
America, Did the Romans Colonize..... 236, 364, 640
American and English City Rapid Transit 452
Ammen, Daniel, Nicaraguan Canal.....623
Ancient Relics in Illinois.....138
Ancient and Modern Engineering and Architecture.....549
Annual Report of Director of Geological Bureau 390
Animal Character, Oddities of.....524
Anthropology and Archæology..... 32, 136, 236, 364, 640, 703
Antiquity of Man in America.....376
April Winds.....123
Arctic Corps of Explorers.....161
Arctic Exploration 392
Art from a Practical Standpoint.....430
Artesian Well, The New, at Russell, Kas. 66
Artesian Well at Fort Scott, Kas.....485
Astronomical Discoveries, Recent 703
Astronomy...130, 188, 306, 399, 523, 580, 702
Atlantis, The Lost.....434
Atmospheric Haze of 1883-4.....447

Bailey, E. H. S., American Association, Meeting of.....287
Bailey, E. H. S., Kansas Cane and Sugar Association 666
Bailey, E. H. S., Artesian Well at Fort Scott, Kas 485
Baldwin, M. O., The Panama Canal.....446
Balloon, Tissandier's Electric..... 85
Barometric Pressure, Direct and Indirect.277
Barrera, The Conspiracy of. 88
Bascom, Dr., What Members of State University Owe to the State.....106
Bassett, D. A., Crawfordsville Crinoids...556
Bent, Capt. Silas, Birth of the Tornado... 37
Bent, Capt. Silas, Meteorology of the Mountains and Plains of North America 626
Biology.....576
Biological Survey of Kansas, The Washburn.....516
Birth of the Tornado 37
Black-Bird, Death of 217, 243
Black-Bird —Indian Chronology Untrustworthy.....361
Black-Bird.....362
Book Notices...50, 142, 205, 278, 340, 394, 526, 598, 659, 717
Botany.....1, 507
British Association at Montreal 296
Broadhead, G. C., Mines of Carterville, Mo. 70
Broadhead, G. C., Black-Bird 362
Broadhead, G. C., Gravels of Southern Kansas.....453
Brown, R. J., An Address.....454
Brown, R. W., Ancient and Modern Engineering and Architecture.....549
Browning, Dr. J. B., The New Phrenology 669
Burlington Gravel Beds.....366
Bureau of Scientific Information.....409
Buried Cities.....440

Cable Railway, The Kansas City.....541
Canal, The Nicaraguan 623
Carpenter, L. G., Eruption of Krakatoa..150
Case, Theo. S., Kansas City Academy of Science 120
Case, Theo. S., Rescue of the Greely Expedition.....166
Case, Theo. S., The New Orleans Exposition.....596
Case, Theo. S., Thermometers..... 632
Case, Theo. S., Washington Monument...501
Cause of Solar Heat.....533
Cave and Cliff Dwellings of Arizona.....647
Characters as Resulting from Culture.....118
Cholera, The Safe-guards of America Against 155, 713
Cholera, The Causes of.....221, 711
Coal Dust in Colliery Explorations.....726
Coal Mined in Kansas in 1883 84
Cocoaine as a Local Anæsthetic.....462

Coleoptera of Kansas—A Correction.....394
Collett, O. W., Black-Bird—Indian Chronology Untrustworthy.....361
Collett, O. W., Conspiracy of Barrera..... 88
Collett, O. W., Death of Black-Bird.....217
Collett, O. W., Louisiana—How Lost to the French.....336
Colorado, Its Mining, and Other Attractions.....000
Commencement at Kansas University.....106
Commencement Exercises at Washington University, St. Louis.....117
Commencement State Normal School, Emporia, Kas.....117
Conclusions regarding the Waring System of Sewerage.....384
Consciousness, Where does it reside?.....677
Conspiracy of Barrera, The..... 88
Cook, J. W., Tissandier's Electric Balloon..... 85
Cope, Prof. E. D., Evolution.....120
Copper Implements, Use of, by American Aborigines.....705
Copper in the Drift of Iowa.....151
Correspondence.....274, 392, 590
Cragin, Prof. F. W., Some Geological and Topographical features of Southern, Kansas.....678
Cragin, F. W., Tertiary of Harper Co., Kas.....652
Cragin, F.W. Biological Survey of Kansas 516
Crawfordsville Crinoids, The.....556
Creators of the Age of Steel.....251
Curiosities of Gila Country, N. M., Natural and Artificial.....138

Dakota Group, The Flora of..... 9
Dawson, Wm., New Zealand.....177
Dawson, Wm., Monthly Astronomical Notes.....306, 399, 445, 523, 586, 652,
Death of Black-Bird.....217, 243, 361, 362
Description of Marble Cave, Mo.....614
Did the Romans Colonize America?..... 236, 364, 640
Difficulties in Searching for Truth.....655
Directions for Collecting Vertebrate Fossils.....219
Direct and Indirect Barometric Pressure.277

Earthquakes, Great.....125
Eclipse of the Sun of March 16th.....653
Editorial Notes.....61, 157, 222, 286, 348, 410, 473, 539, 600, 667, 730
Educator, Music as an.....119
Education Outside the Schoolroom.....101
Education.....106, 261, 333, 655
Edwards, Pres't, Character as Resulting from Culture.....118
Electric Lighting, Progress in..... 15
Electricity and Magnetism.....685
Entomology..... 13
Engineering.....96, 245, 328, 541, 623, 709
Engineering and Architecture, Ancient and Modern.....549
Eruption of Krakotoa, The.....150
Evolution.....120, 512
Europe, Technical Instruction in.....333
Explorers, Arctic Corps of.....161

Fatigue of Metals.....699
Fanatics.....108
Fee, Dr. John, Sanitary Plumbing.....605
Flora of the Dakota Group..... 9
Forces of Inorganic Matter.....225
Ford, Mrs. S. M., Art from a Practical Standpoint.....430
Fossils of Kansas City and Vicinity..... 72
French, F. G., Technical Instruction in Europe.....333
Fulton, A. R., Copper in the Drift of Iowa.....151
Fulton, A. R., Scientific Progress.....190
Fulton, A. R., Death of Black-Bird..... 243
Fungi—Their Nature and Habits..... 1

Geography.....161, 351
Geological and Topographical features of Southern Kansas.....678
Geology.....25, 386, 477, 556, 615, 668
Geology in Genesis.....25, 77
Geological Survey of Kansas.....563, 567
Germ Origin of Infectious Diseases..... 377
Goodnow, I. T., Cave and Cliff Dwellings of Arizona.....647
Grasses of the Great Plains.....469
Gravels of Southern Kansas.....453
Great Earthquakes.....125
Greely Relief Expedition.....58, 166
Growth of the Republic of Chile..... 95
Gulf Stream, The..... 23

Habitability of Other Worlds.....130
Harper County, Kas., Tertiary of.....652
Hail-storm, A Remarkable..... 46
Hallowell, J. K., Mining Outlook in Colorado for 1883.....274
Hanna, J. W., Forces of Inorganic Matter.....225
Hanna, J. W., Solar Dynamics.....308
Haze, Atmospheric, of 1883-84.....447
Health, Relation of Soil to.....180
Hickman, E. A., The United States in 1780, 1880 and 1980.....694
Higdon, J. C., Recently Patented Improvements.....59, 148, 209, 281, 407, 468, 538, 598, 664, 722,
History.....88, 336, 361, 690
History of the Telephone.....194
Holden, Mrs. H. M., The Lost Atlantis...435

Identification of Minerals.....425
Improvement of the Mississippi River....328
Infectious Diseases, Germ Origin of.....37
International Electrical Exhibition.....34

Iowa, Copper in the Drift of... 150
Iowa State Academy of Science.....150
Irish, C. W., Did the Romans Colonize America ?.....643
Is the Rainfall of Kansas Increasing ?....456
Isthmian Canal.....260
Items from the Periodicals.....63, 159, 224, 349, 413, 475, 602, 668, 732

Jones, Prof. F. A., Music as an Educator.119
Jones, Prof. F. A., The Three Genera of the Greeks.....213

Kansas, Coal Mined in, in 1883.....84
Kansas, Coleoptera of.....394
Kansas, Geological Survey of... .....563, 567
Kansas Sugar and Cane Association.....666
Kansas University, Commencement at....106
Kansas and Western Missouri Social Science Association.....101
Kansas, Washburn Biological Survey of. 516
Kansas Weather Service.....49, 122, 204, 276, 339, 405, 451, 631, 708
Kansas City Academy of Science.....120
Kansas City Cable Railway.....541
Kansas City, Fossils of.....72
Kansas City, Sewerage of.....96
Kansas City, Street Pavements of.....487
Kirk, W. R., Lost Arts in the Patent Office.....283
Knaus, Warren, Coleoptera of Kansas....394
Knaus, Warren, Some Older Tornadoes...124
Knight, W. B., Street Pavements of Kansas City.....487
Krakatoa, The Eruption of.....150

Laboratory That Jack Built, The.....472
Larkin, E. L., Velocity.....188, 580
Last Submersion and Emergence of S. E. Kansas 477, 565
Life of Prof. B. Silliman, Sketch of.....636
Longevity as Affected by Climate and Maturity,.....126
Lost Atlantis, The.....435
Lost Arts in the Patent Office 283
Louisiana—How Lost to the French.....336
Lovewell, Prof. J. T., Kansas Weather Service.. ... 49, 122, 128, 204, 276, 339, 405, 451, 631, 708
Lykins, Wm. H. R., Fossils of Kansas City and Vicinity.....72
Lykins, Wm. H. R., Rambles of a Naturalist About Kansas City.....605

Marble Cave, Mo. Description of.....614
Mason, Prof. Otis T., North Australian Tribes.....32
Matter, Inorganic Forces of.....225
Maturity and Longevity as Affected by Climate.....126
Maxwell, S. A., Remarkable Hailstorm .. 46
Maxwell, S. A., April Winds.....123
McCarty, R. J. Washington Territory.....351
Medicine and Hygiene..180, 377, 462, 615, 711
Meteorological Discoveries 196
Meteorological Summary for the Year 1884.....587
Meteorology.....37, 122, 196, 276, 339, 400, 476, 587, 626 708,
Meteorology of the Mountains and Plains of North America.....626
Meteorology Revolutionized by the Weather-Map.....40
Mines of Carterville, Mo.....70
Mineral Belts of the Continent.....682
Mineralogy.....425
Minerals, Identification of.....425
Mining Operations of the Romans.....387
Mining Outlook in Colorado.....274
Mississippi River, Improvement of.....328
Missouri River Commission.....54
Models of the Prehistoric Pueblos 374
Montreal, British Association at.....296
Morrison, G. B., Text-Book as an Element in Science Teaching.....270
Music as an Educator.....119

National Exhibit at the New Orleans Exposition.....536
Natural Curiosity in California 623
Natural and Artificial Curiosities of Gila Country, N. M.....138
New Artesian Well at Ft. Scott, Kas.....485
New Mexico, A Paper Upon.....690
New Orleans Exposition, The 536, 590
New Route to Europe, Proposed.....59
New Volcano.....179
New Zealand 177
Nicaraguan Canal.....539, 623, 709
Nipher, Prof. F. E., Electricity and Magnetism.....685
North America, Meteorology of the Mountains and Plains of.....626
North Australian Tribes.....32
Noyes, Isaac P., Meteorological Discoveries.....196
Noyes, Isaac P., Meteorology Revolutionized by the Weather-Map.....40
Noyes, Isaac P., Red Skies.....400

Oddities of Animal Character.....524
Old Egypt.....139

Panama Canal, Influence of, Upon Climate.....446
Paris Wood Pavements.....245
Parker, John D., Arctic Corps of Explorers.....161
Parker, John D., Arctic Exploration.....392
Parker, John D., Burlington Gravel Beds.386
Parker, John D., Kansas Scientific Survey.....557
Parker, John D., Russell (Kas.) Artesian Well.....66
Payne, H. R., Germ Origin of Infectious Diseases.....377

Pearsons, G. W., Sewerage of Kansas City. 96
Perkins, W., Longevity and Maturity as Affected by Climate 126
Physiology 669
Phrenology, The New 669
Permanency of Wrought Iron Structures.....727
Physics.....15, 85, 225, 413, 512,
Plea for the Occult.....413
Plumbing, Sanitary 605
Popenoe, Prof. A. E., Russian Fruit for American Prairies..... 47
Practical Studies in Geology.....481
Prehistoric Man in Egypt and Syria.....703
Prehistoric Statues.....559
Pritchett, Prof. C. W., Notes upon Dr. Watson's Article.....700
Problem of Rapid Transit Solved(?).....498
Proceedings of Societies 120, 190, 287, 406, 723
Proceedings of St. Louis Academy of Sciences.....406, 723
Proctor, R. A., Causes of Solar Heat.....553

Railroad Legislation in Europe, New....153
Rainfall of Kansas Increasing? Is the....456
Rambles of a Naturalist Around Kansas City..... 650
Rapid Changes in History of Species.....522
Recent Progress in Economic Entomology 13
Recently Patented Improvements.....59, 148, 209, 281, 346, 407, 468, 598, 664, 722
Red Skies.....400
Relation of Soil to Health 180
Relative Right of Railroad Companies and the Public.....247
Religion and Doctrine of Evolution.....512
Renaissance, The, in Italy.....697
Republic of Chile, Growth of the..... 95
Rescue of the Greely Expedition.....166
Resulting from Culture, Character as 118
Riley, Prof. C. V., Recent Progress of Economic Entomology.. 13
Romans, Mining Operations of the.....387
Romans Colonize America? Did the..236, 364, 640
Roman Sculpture, Twilight of.....285
Russell (Kas.) Artesian Well, The..... 66
Russian Fruit for American Prairies..... 47

Sadler, H. E., Sketch of the Life of Prof. B. Silliman 636
Sanitary Plumbing.....605
Sanitation in St. Louis.....729
Schlieman – His Life and Work..... 34
Scientific Miscellany.....54, 148, 209, 284, 344, 407, 598, 664, 722,
Scientific Progress.....190
Schoolroom, Education Outside of the....101
School and State... 261
Selenium and its Uses 234
Seventeenth Annual Meeting of the Kansas Academy of Science.....454
Sewerage of Kansas City, Mo., The..... 96
Sewerage System, Conclusions Regarding the Waring.....384
Shaw, C. A., Direct and Indirect Barometric Pressure..... 277
Sketch of the Life of Prof. B. Silliman...636
Snow, F. H., Meteorological Summary for 1884.....587
Sociology. 101
Social Science Convention of Kansas and Western Missouri..... .....101, 429
Solar Dynamics.....308
Solar Heat, Cause of..... 533
Some Older Tornadoes.....124
Spots upon the Sun, What Were They 699
Spouting Oil Wells in Russia..... 475
Stamped Railway Wheels..... 500
State of Iowa 160 Years Ago.....470
State Normal School, Kansas, Exercises at.....117
Sternberg, C. H, Flora of the Dakota Group... 9
Sternberg, C. H., Directions for Collecting Fossils.....219
Sternberg, C. W., Practical Studies in Geology..... 481
Street-Car Rail, A New 496
Street Pavements of Kansas City.....49 6
Stevenson, C. W., School and State..... 261
Stevens, Mrs. F. E., A Paper Upon New Mexico.....690

Taking Aim – Two Eyes or One?..... . 58
Technical Instruction in Europe 333
Telephone, History of the.....194
Templin, Rev. L. J., Age of the World...510
Templin, Rev. L. J., Fungi—Their Nature and Habits..... 1
Templin, Rev. L. J., Vegetable Dissemination 507
Text-Book as an Element in Science Teaching..... 270
Territory of Washington.....351
Tertiary of Harper County, Kas..... ..652
Thacher, S. O., Fanatics.....108
Thermometers.....632
Three Genera of the Greeks.....213
Thoughts on Science Teaching 531
Tiffany, F. B., Cocoaine as a Local Anæsthetic. 462
Tin Mines of West Virginia 684
Tin Fields of Mexico.. 684
Tissandier's Electric Balloon..... 85
Tornado, Birth of the..... 37
Tornadoes, Some Older..... 124
Trowbridge, S. H., Difficulties in Searching for Truth..... 655
Trowbridge, S. H., Geology in Genesis..25, 77
Twilight of Roman Sculpture.. 295

Underground Wires.....554
United States, in, The 1780, 1880, 1980...694

Van Horn, Hon. R. T., A Plea for the Occult.....413
Vegetable Dissemination.....507
Velocity.....188, 580
Virgilian Proverbs.....212
Volcano, A New.....179

Walter, E W., New Artesian Well at Ft. Scott, Kas.....485
Washington Monument, The.....501
Washington University, St. Louis, Commencement Exercises of.....117
Washington, The Territory of.....351
Watson, Dr. Louis, Certain Spots on the Sun.....699
West, E. P., Last Submergence and Emergence of Southeastern Kansas.....477, 565
What the Members of a State University Owe to the State.....106
Wheats, A Study of American.....724
White, A. J., Colorado.....351
Winchell, A., Habitability of Other Worlds.....130
Winchell, A., Thoughts on Science Teaching.....531
Winds, April.....123
Worlds, Habitability of Other.....130



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PHYSIOLOGY.

THE NEW PHRENOLOGY.[1]

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It is the fate of humanity to do things in almost every possible wrong way before it hits upon the right one. Whether this arises from the fact that knowledge is something too precious to be lightly entrusted to man, or is something so indifferent that its possession will make little difference with the final result, is a question that we are not yet in position to determine. It is certain that in the natural order of things, by which knowledge is placed as a premium on effort, more stress is placed upon the effort than upon the acquisition. And the more important the knowledge to be acquired, the more does it seem to be beyond our reach. To know one's self has been considered in all ages the climax of human wisdom; and yet to know one's self has been the despair of the ages. The effort, like all others, has been made in the wrong direction and necessarily so. Suppose man placed in the center of the universe, in the center of a sphere whose boundaries are ever increasing outward, and he is to search through this sphere for a law or a fact whose existence is only inferred; there are a million chances to one that he will look in a thousand wrong ways first. The chances are still more against him when he has to investigate himself, for here, besides finding the law on which to string his beads of fact, he must investigate the nature of knowledge

1 Read before the Kansas City Academy of Science, February 22, 1885.

itself. From within outward we go by-paths already formed for us. We use ourselves as self-registering yard-sticks, and the skull is a cup that contains our measure of the universe. The distance of a star is so many lengths of hand, or foot, or arm; the weight of a body is so many units of muscular effort. These measurements and weight preserved for us and rendered automatic by the continuity of the race form the bulk of our knowledge. The law by which our experience is marked upon our children, the fact that they look upon the world with eyes black or blue, because our own eyes are black or blue, and walk erect or bent by the weight of ancestral sins, this is what makes our knowledge cumulative and what it is. We must look upon humanity as a tree, and man as its blossom and fruit. Every blossom that falls scars the tree and modifies the trunk, and yet the tree grows on; and that explains to us the poet's lament over a nature

So careless of the single man,
So careful of the race.

This kind of knowledge, however, when applied to man, does not give results by any means so satisfactory as we could wish. It can give us a knowledge of the relations of man to society or to individuals, but we must know more than that if possible. We must know if possible how these weighings and measurings are projected into consciousness, their processes recorded and other things inferred from them. Consciousness, the little mirror held up to reason and to nature, must look at herself in her own glass. But how, when she throws no shadow? Mind, the infinitesimal piece of the infinite, which we say sits somewhere within, controlling the brain and nourishing it with its shadow, must be made tangible. That is the task. Let us see how we are progressing towards its accomplishment. If we should sit down and watch the action of some new complicated machine, and guess at the peculiar arrangement of wheels and levers within from the work that it accomplishes, certain gross results might indeed be arrived at. We might be able to calculate that another machine of a definite size would lift a certain definite amount of material, or would be able to displace a certain amount of matter. But our knowledge of its effective workings would not be such as would be required to repair it, or give us the full control of its energies. And yet this is identically the process that philosophers and scientific men have applied to man. They have set themselves to work to watch him upon the outside. They have seen that he thinks and have analyzed his thoughts so far as they appear in action, dividing them up into reason, judgment, memory, etc. This is as far as introspective philosophy or metaphysics can go.

Now I do not intend to say that the results thus obtained are worthless. They have a certain value, corresponding with our ideas, or, we might say with more justice that your ideas have been modeled upon them. Such terms as memory, imagination, etc., run through all the mazes of expression and have become woven into the fabric of human speech. With them as a basis our knowledge of mind became crystallized, became pseudo-scientific. Men reasoned; the mind builds the brain for its temple, expands it and contracts it to meet its wants. If

then, the person shows great powers of memory he must have a special organ somewhere in the brain whose prominence will be marked upon the skull; if he has great powers of expression his skull must be pushed out somewhere so as to give the brain room in that direction. A man with certain prominences on his head will steal or be a murderer, another with certain other prominences will be a poet or a musician. Seventy-five years ago Gall and Spurzheim took up this idea, amplified it and laid the foundations of the so-called science of phrenology. It is not my intention to discuss this very much. While we may say that as a general thing a man's character corresponds to his outward shape, we are still very much in doubt how much strength of mind is dependent upon size of brain, and we are by no means warranted in saying that because there is a depression in a man's skull at a certain point, there is a corresponding vacuity in his mind. A wit of our generation, who combines a knowledge of anatomy with a rare talent for poetry, has said, that we might as well try to tell the amount of money in an iron safe by feeling of the knobs upon the outside, as try to tell the amount of sense a man has by feeling upon the outside of his skull. This also is not entirely true, for while the safe might be empty, the skull being to some extent moulded by the brain and corresponding with the rest of the man, would show us several things. From its height we might judge somewhat of the person's stature; from its thickness and the size of its prominences, something of his muscular strength; perhaps from its apparent age and size we could tell that the person using it had had intellect enough to perform the ordinary functions of life, but to make a picture of his intellectual capacity would be beyond our power. Given a fossil bone and a naturalist can reconstruct some grotesque monster that sprawled and splashed through the prehistoric ages, confounding our theories of geology. He can tell sometimes whether it would be a reptile or a mammal; can make a rational guess as to whether its skin would be thick or thin and what its habits of life would be. This is a legitimate use of the scientific imagination, or more strictly perhaps of scientific induction. Given the bone of a man he could build up a symmetrical man, but the variations produced by civilization would render his restoration uncertain. He would have nothing to guide him as to whether the hair was light or dark, as to whether the man was civilized or barbarous, and these are all important factors in determining the grade of intelligence. For certainly no one will deny that blue eyes look upon the world differently from black ones, and that a thick skinned man is less tormented by the slings and arrows of outrageous fortune than one whose skin is thin.

When it comes to physiognomy much more can be told, though how much more is a fair matter for question. Certainly a man's soul should shine forth in his face and in his general appearance, and yet here there are some things that we do not understand. The big Roman nose led the Roman armies to the dominion of half the world, and yet the big Roman nose, the nose of Antony and Augustus, arches to-day the faces of innumerable Italian beggars and organ-grinders. Go to day and sit down among the ruins of Rome and a man as stately as a Roman senator, or a woman as determined as Cornelia, the mother of the

Gracchi, will come to you and hold out the hand for alms. The mildest mannered man I ever knew, a man who I think would not knowingly harm man or beast, carried through life the face of a hawk. One of the most determined men I ever knew had a nose as pug as the variest child of fickleness. Yet reasoning a priori, we would expect that inasmuch as the muscles of the face are used to express the passions, the frequency of their action would cause a muscular growth by which the predominant passion would become marked there permanently. But some faces seem to be masks or puzzles; some faces like Talleyrand's words are made to conceal thoughts and vices. But in this connection some facts show that the fault may be more in the reading than in the face. The main feature of the mesmeric state is that the subject for the time being loses his will power and becomes a human automaton, obeying outward impressions. If, when in this state, you tell him that he cannot bend his arm, he cannot do it; if you tell him that there is fruit growing upon the icy street, the mere suggestion will cause him to see it, and make endeavors to reach it. Place his head then in the position denoting pride, and he will immediately display the feeling; contort his face until the muscles convey the impression of anger and he will show mental signs of rage. The mere action of the muscles upon the brain has suggested these feelings to the nerve-centers in the inverse order from that in which they are usually presented. Position then, and feature, must be intimately associated with the manifestation of character, and if we cannot read it aright the fault must be our own.

But there is something more in knowing humanity than the mere ability to read individual character. If phrenology had really given us what it pretended, a key by which every man's character might be read and his actions in any particular case predicted, the central features of the problem would still remain unassailed. We should be very little nearer to knowing man in the abstract—to knowing how the brain uses itself, as a measure or a weight. We are still upon the outside, watching the effects produced by the machine. Spurzheim, it is true, made an important step in dissecting the brain when he divided it from below upward, showing that the white fibrous matter passed up from the periphery of the body and ended in the grey matter of the cortex, but there the matter ended with him. Whether he thought that sufficient to prove the truth of his teaching or not I can not say. But like every new discovery it was simply a door opened by which a hundred doubts rushed in.

After his time a strange activity awoke in scientific circles. Men interested in knowing what life was, men who could think and who tried to lay aside their prejudices, began to question nature by experiment. Not one man alone, but a hundred applied the interrogation, striving to arrive at the truth from different directions, and to counteract one prejudice by another. In the course of these experiments they learned some things that have materially changed our views of the workings of the mind and the division of its faculties. And first to understand these experiments we must start in with the postulate that it is impossible for us to know anything about mind except with the brain as a basis. As

long as man remains man he lives and acts and cerebrates through continued change in his nervous tissue. Brain and muscle are alike in their demands upon the blood for nutrition, and the exercise of their powers is a continued death in life. If mind can exist without brain we so far have been unable to discover it. But this is not to deny that there is a power back of mind which is mightier than it is, and which differs from it in quality and quantity. It is merely to say that mind as we know it is not an ultimate, it is the result of certain conditions. How do these conditions produce in us the various processes by which we know? The first thing to do then was to find out the functions of the various nerve tracts. The brain looked at through a microscope was worse than a labyrinth, worse than a tropical jungle. There were cells upon cells of grey matter with numerous polypus-like branches extending off in every direction, connected here and there by fibres, hundreds of thousands in number, and giving no hint of what their office might be. These brain-cells, looked at roughly upon the outside, seemed rolled up together in convolutions, separated from each other by deep sulci. A fair comparison would be that the nerve tissue was arranged like a cauliflower in blossom. These convolutions were nearly uniform in position and arrangement in all brains, but from this nothing could be inferred. So very inconclusive, indeed, were the first experiments, that Flourens, the Frenchman, promulgated the idea that the mind acted as a whole, that the removal of any part of the hemispheres affects all the cerebral functions alike, and that therefore every part of the brain has the same functions. This opinion held almost complete sway in the scientific world for a quarter of a century, and even now is believed in some very respectable quarters. Its incorrectness was first shown by the observations of Broca upon disturbances of speech caused by injury or disease in a limited portion of the frontal lobes. This was followed up by the observations of Meynart of Vienna, who from anatomical reasons and from post mortem observations concluded that the fore part of the brain possessed motor and the posterior sensory functions. After this the animal becomes our teacher. Science is a religion that demands its martyrs. The brains of innumerable dogs, rabbits, and monkeys were interrogated with knife and battery, and the results obtained were compared with those already known. Ferrier of England laid bare the brain of a dog and placed the poles of his battery upon certain nerve centers. When one portion of the brain was irritated he noticed that the dog would draw up the corners of his mouth, show his teeth and snarl. When another was touched the pupils of the eye would expand. When still another, the animal would raise his head as if on the lookout for game. These experiments must be repeated and verified a thousand times before they could be received and believed by the scientific world.

Men realized that facts are like diamonds cut with facets. If the answer to a problem is true, there must be many ways of reaching it. And especially must this be the case when we are dealing with things so intricate as the nervous system, where facts must be to a great extent inferred. If these were really localized centers, animals or men would be deprived of the power conferred by these

centers when they were taken away. So they proceeded to slice away certain portions of the brain, or wash them away through holes in the cranium, and then noticed the results that followed. Not content with this they took advantage of the law of nerve degeneration and produced this degeneration artificially. Waller, an Englishman, had shown that nerve tracts when separated from their centers degenerate in the direction in which they convey impulses. Those conveying impulses outward then, as the nerves of motion, would degenerate outward —the sensory nerves inward. Taking this as a starting point, Von Gladden, of Munich, enucleated the eye balls and removed various portions of the brain from new born animals, then allowed them to grow up and killed them to trace the portion of brain that had atrophied. From the results of all these experiments combined it has become pretty definitely settled in the scientific world that certain portions of the brain have functions different from those of other parts. Inasmuch as the brains of animals differ in their arrangement from those of men, these results must be compared with others and corrected before the final conclusion was drawn, and then it was found out that the brain is to a certain extent a map of the man. We now know with a sufficient degree of certainty that the forepart of the brain is taken up by the centers for muscular action. First comes the centers for the muscle that raises the head; then that for the muscles of the arm next that for the muscles of the mouth and throat; then those for the lower extremity. After this, in the back part of the brain, in the occipital and temporal portion, as we call it, come the centers for sight, hearing, smell, etc. This, of course, gives us a new topography, and so far is, perhaps, an improvement on what Gall and Spurzheim furnished us, because it conforms more to the nature of facts. But it does not give us a much nearer knowledge of the action of mind. If it stopped there, it would be of interest to the physician and the man of science, but would not much concern the philosopher. Like a new land discovered, it would be so much added to the habitable globe, but would give us no nearer insight into the principles that rule the world.

Certain new things, however, have been added that materially change our ideas of cerebral processes, and show us that terms which we before used to signify the ultimates of our mental analysis are capable of still further resolution. No brain action, be it ideation, or simple reception, is simple, but all is complex in the highest degree Back of it all—back of our consciousness—looms the gigantic form of our unconsciousness. We feel. What does that imply? Something more than the mere contact of the hand with a body. It implies a change in the equilibrium of nerve structure, extending from the skin up through the different ganglia of the spinal cord to the cortex of the brain where a very complicated interpretation goes on. That is the unconscious part in us. Whether this is in the nature of a vibration, or a change in polarity like that by which the needle follows the pole, we cannot tell. How the nerve fibers, the little lines of telegraphic protoplasm, communicate with the hundred cortical cells whose united action is necessary for this interpretation we cannot tell. Only when the interpretation is completed does it come up to our consciousness, arouse it as if by a

punch in the ribs, and say: Here is something to know. So when we move a muscle it seems a very simple thing to do. But of how much of the moving mechanism are we conscious? We may be conscious of the motive that causes us to move it. We may to a certain extent perceive the contraction of muscular fiber. But we are not conscious of the co-ordination of brain cells, and the impulse sent out along the nerves to the muscles. And this unconsciousness extends up to psychic circles, to the higher forms of mental action. If there are cells in the brain specially set apart for thought, they cannot be distinguished by the microscope or by any process that we are masters of. We cannot differentiate their modes of action from that of cells we know, and as the elaboration of thought results in tissue waste as rapidly as the use of muscle, we must suppose that it is accomplished by a similar cell co-ordination. This also belongs to the field of the unconscious. In fact it is the most unconscious and unruly part of us. It is a common saying, truer than we think, that we cannot control our thoughts. The muscular effort we can control. It comes when we require it, and it is always strength; but with our thoughts it is like Glendower and the spirits.

"I can call spirits from the vasty deep."

"Why, so can I or so can any man. But will they come when you do call for them?"

We set down to meditate and they come to us, full grown, like Minerva from the brain of Jove. I do not wonder that some persons think they are inspired. All of us are inspired in this way, and the grandest thoughts of the human brain have this mechanism of inspiration in the same manner as the humblest. In some cases of disease this unconscious action reaches a point which the senses are unable to correct. Hallucinations then appear projecting themselves into the various fields of cognition. Persons hear voices, see visions, and the inspiration runs riot, becoming insanity. From this unconscious mechanism other things that have puzzled us take their explanation. How do we get our knowledge of time? It is a mental blank, and it eludes our analysis. We can only understand it as a succession of something occurring at regular intervals. In our waking state we cannot guess at these intervals with any degree of exactness. Rip VanWinkle, grown old in his twenty years' sleep, could not convince himself that he had slept more than a single night. We can form no mental conception of time. And yet if we retire at night with the firm resolve to wake at a certain hour, we find that after a few trials we can do it. How can we explain it? In no way, rationally. And yet the fact that Rip VanWinkle grew old and gray while he slept explains the matter for us. The unconscious mechanism within is our time-keeper, keeping its record in heart beats and in its own growth and decay. So many particles of matter taken on, so many others cast off, one taking the place of the other seemingly, yet not doing it exactly, until by and by the power of taking on is exhausted and the circle of existence is complete. That is the history of the brain cell as it is of all other cells. Next, these investigations have widened out our ideas of the complexity of sensations and have given us the means of resolving them still further. Memory, we now know, is no special

localized organ or power. Phrenologists placed this, if I remember rightly, somewhere in the middle of the forehead where the two tables of the skull separate and leave a cavity between them called the frontal sinus. Here of all places throughout its extent the form of the brain corresponds least with that of the skull. In fact, as far as I can judge, the greater the prominence of the skull on the outside the greater is the depression inside. Yet here they located the storehouse, the arsenal of the mind, and judged of its size by the outward protuberance. Well, investigation has shown us some curious things in regard to memory. We can no longer look upon it as a place in the brain where facts are pigeon holed, or a picture gallery where countless images are hung up to be rummaged over when the mind requires to look at them. The probabilities are great that memory is a general property of nervous tissue, and perhaps of other tissues still.

Munk and Lucianini, experimenting upon the localization of the various senses, found that when certain portions of grey matter were sliced away, animals failed to recognize objects. In this condition an animal may see an article of food and yet will not eat it until he has subjected it to touch and smell. He may hear sounds and yet will not know their meaning. This they have called psychical blindness or deafness. If a dog thus made blind be led into a garden where it has been accustomed to stay, it proceeds straight along the paths, successfully avoiding the contact of hedges, walls and other fixed obstacles which it comes across. The animal is not blind; he has simply lost his memory of things seen. If a dog thus made deaf be called he will turn his head and show signs of hearing, but he will not follow the voice of his master. He is not deaf. He has simply lost his memory of sound. Immediately this commences to be replaced, not by the supplying of new tissues, but by the neighboring tissues taking on the mode of action of the old. This same phenomenon sometimes occurs in man through disease. In one recorded case the patient could see a chair that had been placed in his way, but only avoided it after having once stumbled over it. Fire brought close to his eye did not frighten him. He touched it to find out what it was, and only then avoided it. He could see wine, but seemed not to know its use until it was touched to his lips. Cases of word deafness are more common, cases in which the person afflicted does not recognize the meaning of a word when he hears it. What is the interpretation in these cases? That the store of sensory experience has been destroyed? In a certain sense, yes; in another, no. The brain tract used for that purpose had simply become disabled, but another brain tract showed itself capable of taking up these experiences and elaborating them. From these and other things certain philosophers have formulated the idea that memory is simply the faculty that nerve tissue has to persist in the same direction of arrangement for its particles. Every impression produces, we will say, a rearrangement, marked in its structure, and when recollection comes to us it is simply a return to this rearrangement. There are many things to substantiate this. The older the impression produced the more deeply does it become scarred upon the organism. The newer the impression the less firmly is it

fixed, the less often has it been adverted to. So in the phenomena of mental decay we have the newer impressions dying out first, because they are less firmly organized into the system.

The old man in his second childhood goes back literally to his first childhood, and his memory is that of the child. It is sometimes to be commented upon that we have not found any tracts in the brain of higher significance than the sensory tracts. One or two cases on record of wounds in different parts of the brain show interference with the will, but it is still somewhat doubtful where these parts of the brain are located. The power of speech should be connected with the power of thought, for it is almost impossible for us to think without language. Words are the coins of thought, and there is no barter that can take their place. Somewhere back in the occipital cortex is supposed to be the center of speech. Somewhere perhaps in the field where all the senses seem to meet and overlap each other. We cannot locate this so well as many other things, because in animals on which our experiments are carried on the field of language is very small. Many phenomena of disease, too, show that a great many of our psychic processes are carried on in connection with the senses. In a person suffering from brain disease, it was noted that when he tried to grasp an object in the hand of the physician, he moved his head from side to side, then seized the physician's arm and followed it nntil he reached the hand. He could not count objects without touching them. Often in attempting to touch objects he reached beyond them. In counting small objects he often overlooked them, or counted the same ones repeatedly. At a later period he could recognize small letters, but if they were combined to form a word he could neither read the word nor point out the separate letters. There was simply a hemorrhage in the brain interfering with the centres of sight, and yet it interfered with the mental conceptions of space, position and number. Hundreds of similar examples might be brought forward if it were necessary, but enough has been said. We are not yet done with such investigations. Perhaps we never shall be. We know from experience that every avenue towards truth is closed by a question, by a doubt. We are a little nearer to the solution of some things. What is our consciousness? The elaborated result of cell action, the foam that crests the wave of our unconsciousness. What is memory? Persistence of arrangement. What is reason, judgment, etc.? Elaborations of sensory memories and impulses. That is as far as we have gone, and it is at least a different view of affairs from that which held the world so long.

WHERE DOES CONSCIOUSNESS RESIDE?

We have outlined the structure of the cerebro-spinal system, and have stated what may fairly be set down as established concerning the functions of this system up to the cerebral hemispheres. With respect to the presence of consciousness in the parts already examined, it is plain that opinions radically differ. Some maintain that consciousness is not manifested apart from the action of the cere-

brum, that all nerve-activities below this organ are reflex, their only distinctions being in the matter of complexity. Others are eqully positive that consciousness accompanies all nerve-actions, while others still assert that certain organs below the cerebrum—viz.: the pons Varolii, cerebellum, optic lobes—form a sensorium commune where consciousness in some form appears. It is my opinion that this last conclusion has not, as yet, been established or refuted. I regard it as the most rational of the three in the present state of knowledge. If we accept it, we must recognize at the same time a distinction between elementary consciousness and the full consciousness of an intellectual operation. Many facts in every one's experience bear out such a distinction. We are often conscious without knowing the object or occasion of consciousness; being half-aroused, we feel rather than perceive. It is possible, and from the evidence it is even probable, that provision for this rudimentary consciousness is made by the nerve-masses between the medulla and cerebrum.

Whatever conclusion we adopt respecting this matter, the significant fact remains that consciousness is certain to appear in connection with nerve-matter; sooner or later the question of a strictly materialistic interpretation must be faced. After ascertaining the present state of the case with regard to localization of functions in the cerebrum, the induction must be drawn as to the nature of the relation between nerve-matter and consciousness. Grant that this induction shall be more or less a speculation, we need, I think, to remember that all reasoning is speculative, from the nature of the case speculative, and that the only distinction between credulity and reasoning is this, that credulity is both beyond the facts and contrary to the facts, while reasoning is beyond the facts but *according* to the facts.—Professor W. R. Benedict on "The Nervous System and Consciousness," in *Popular Science Monthly for April.*

GEOLOGY AND MINEROLOGY.

SOME GEOLOGICAL AND TOPOGRAPICAL FEATURES OF SOUTHERN KANSAS.

F. W. CRAGIN, SC.B.

Several hasty excursions made by the writer during last summer, autumn, and winter, through parts of southern and southwestern Kansas, lying in what had hitherto been, scientifically, the least known region of the State,—the facilities for making which excursions he chiefly owes to the liberal policy of the Atchison, Topeka & Santa Fe Railroad Company in fostering the scientific, as well as the industrial development of the southwest,—have afforded glimpses of

that region which show that it is a field of rich promise for the naturalist, as the Easterly portions are also for the agricultural and industrial immigrant.

The region between Newton and Wellington is for the most part destitute of solid rock; along the railroad quite so, though a few thin beds of crumbling shales are exposed in some of the railroad cuttings. At Wellington, and for several miles westward, the streams and draws make their way through a variety of loose shales, the darker of which are locally known as "slates," a misnomer from which the stream that flows by Wellington has derived the name of Slate Creek. As no fossils were found in the country rock of this region, we can only judge of its geological age by its relation to the neighboring formations, and its close repetition of conditions found in northern Kansas. According to these, it would belong to the permo-carboniferous.

At Wellington, however, occurs a local deposit of sand and gravel which affords, as shown by its fossils, a glimpse of quite recent conditions. The material of this deposit shows the oblique lamination characteristic of rapid and shifting currents. The occurrence in it of numerous unworn fragments of the same argillaceous and calcareous shales that outcrop in the neighboring ravines, together with the gravels of the region immediately northward and westward, show that it is more recent than the general country rock of that region; and the contained fossils (*Bison latifrons*, *Mastodon*, *Elephas*, *etc.*,) clearly refer it to the champlain.

The further occurence in it of beds of recent fresh-water shells taken in connection with the evidences of torrential currents, show that we once had here a rapidly flowing river. Several of the highly inclined wedge-shaped strata of this deposit, though of so recent origin, have been converted into solid sandstone, but the exposure of this sandstone indicates hardly more than a dozen or twenty cubic feet. There occur also here, as in the creek-bed adjoining, curious thin concavo-convex concretions of clayey limestone,* whose form, except for the lack of sutures, often reminds one of the occipital or parietal bone of a human skull. These have perhaps been caused, as is the opinion of Judge Simmons, of Wellington, by the efforts of gases to escape through the strata while the latter were yet in the condition of half-hardened mud.

Westward of the Wellington shales, the country rock is a rusty-brown sandstone. This sandstone is quite similar to that of the Dakota belt which enters the State on the north in Washington County, and, though the single fossil, *Gryphæa Pitcheri*, which I have thus far found in it, is insufficient to determine its exact age, the "ironstones" in which it abounds, taken in connection with the known geographical distribution of the Dakota and absence of Jura-trias northward, leaves little doubt that it belongs to the Dakota, and as such we shall here consider it. On this view, the Dakota member of the Cretaceous in Kansas extends in a belt one or two counties in width from Washington County southwest-

* In several instances I obsereved large irregularly rounded lumps of red clay in this Champlain deposit. If I remember correctly, Judge Simmons has spoken to me of finding similar lumps equal in bulk to an ordinary barrel. These are, of course not *boulder clay;* but I am unable to account for them at present.

ward to Rice, and thence slightly to the east of south, passing into the Indian Territory mainly from Harper County. It has been shown by Mudge to send an arm eastward, along the divide between the Kansas and Arkansas Rivers, to the highlands of Morris County and another westward into Colorado along the latter river, by whose ancient erosion it has been laid bare. In the southern tier of counties, the most easterly exposure of it that I have been able to find is at Milan, in the western part of Sumner County. It occurs also in the bed of the Chikaskia River. Westwardly of this, it is the main country rock as far as the Gypsum Hills (of which it forms the base) west of Medicine Lodge. It has also been exposed by the erosion of the Medicine River and its tributaries at least as far as eastern Comanche County and, near the southern State-line, by a more extensive erosion, further westward, probably into southern Ford County. I have reason to think that it will be ultimately found as far west as the junction of Crooked Creek with the Cimarron River.

In travelling by carriage from Harper to Medicine Lodge, the streams are found to be quite unlike those for which Kansas is so generally reputed. Instead of the slow muddy creeks so largely characteristic of eastern Kansas, are seen rapid brooks,—veritable brooks, with waters limpid as crystal, flowing often over beds of quartz pebbles which, for variety and beauty of colors, would challenge comparison with New England itself. The origin of these pebbles is not far to seek. Capping a line of low bluffs of the Dakota sandstone (the first bluffs we have met in travelling westward from Harper), which extends westward from a point near the Harper-Barbour boundary westward, we shall find a bed of conglomerate, perhaps a foot thick, composed of these same colored pebbles, and in the very act of liberating those pebbles by disintegration. This is certainly the origin of a part, at least, of the pebbles, and is probably one of the persisting members of the tertiary which formerly spread, apparently, over the entire region in Kansas south of the Arkansas River and west of Sumner County, and whose remnants, chiefly in the form of gravel and pebbles mingled with the Dakota sand, may be found in Harper, Kingman, Reno, Pratt, Barber and perhaps other counties. Near the junction of Kingman, Harper and Barber Counties has been dug up, at a depth of something like twenty feet, the metatarsal of a Pliocene horse, indicating an animal of good size and with the peculiarity of very *unequal splints*, a feature not known, I believe, in any Tertiary horse prior to the finding of this specimen. This is undoubted evidence of Tertiary for this region; but it must be borne in mind that these Tertiary deposits *may be modified* deposits, and if this is the case the conglomerate above mentioned may belong to the Dakota, as indeed may be the case in either event, since such conglomerates occur in the Dakota elsewhere.

The great mass of the Dakota sandstone is friable. It appears to be mainly the lower beds that afford stone of sufficient durability for building purposes. In the region about Harper there is a considerable quantity of stone that can be so used; in the vicinity of Attica and Sharon a few thin layers; and from there westward, generally, very little indeed.

While the ironstones are exceedingly abundant, they usually contain so much silica that they could probably not be profitably worked for their iron, even if coal were at hand. Some specimens, however, are nearly free from silica. These bear a striking resemblance to bog-iron ore, and it is possible that, could coal be discovered in close proximity, they might be found in some sections in sufficient quantity and purity to pay for working.

Besides the concretions of iron and silicate, others of lime are common in much of the sandstone. These usually have one side convex and covered with nodular protuberances, the other showing one or more concavities lined with small crystals of calcite.

While the concretions of iron will probably yield no one a fortune, and we should not look even for farthings in limestone concretions, these plain aggregations of common minerals are promissory notes to the farmer that should make his face beam with joy whenever his eye falls upon them. They are as good to him as gold certificates, for they tell him of unstinted gold which they have spread before him and which shall be his for the stooping and taking.

Concretions are formed—often about an organic nucleus—where their component originally existed in small quantities diffused through the rock in which they occur. Their *rationale* is little understood, but that such are the *conditions* of their formation is a matter of observed fact. Lime and iron, then, in a diffused state and in small quantities once existed in this sandstone, the former probably mingled to some extent with traces of phosphates and sulphates. It is plain of the iron, as shown by the color of the sandstone, and is doubtless equally true, if less evident, of the lime and other mineral constituents, that they are but partly expressed by these concretions and that they are therefore still diffused through the strata to greater or less extent, and so in the soils that have resulted from its decomposition.

If to such a soil have been added, as is here probable, small contributions from the gypsiferous clays that once overlaid the sandstones, and still later from the tertiary, the result would be a soil of unsupassed fertility and adapted in the highest degree, by reason of the porosity and capillarity of the sand, to raise large average crops with a small average rainfall, and to withstand drouth when other soils would fail.

Such is the soil of the Dakota belt, at least in southern Kansas. Nor could a better combination of ingredients be found for road-beds. I have driven between Harper and Medicine Lodge in sunshine and in rain, and have found the roads neither dusty nor muddy. Indeed dust and mud are well nigh impossible in such a region, except where some "settle" has accumulated an undue proportion of lime and clay, and these spots are small and the mud shallow.

The only really bad portions of the roads are found along the streams where the waters have washed out the lighter ingredients of the soil, leaving the sand. Here, as in all loose sand the traveling is heavy.

The streams of this region are mostly without appreciable banks, the larger ones, and many of the smaller, having their little sand-hills, and thus aping the

great Arkansas, with whose turbid flood their clear and sparkling waters are in marked contrast.

West of the Wellington shales, native trees soon disappear and we see nothing worthy the name of a tree of spontaneous growth, save one lone cottonwood and a small clump of woods in a ravine far north of the "trail," until we reach the valley of the Medicine River. Here and thoughout the great cañon system tributary to this river, we find the ravines uniformly, if not heavily, timbered. Now almost wholly composed of deciduous trees, the timber in these ravines once embraced many red cedars. Especially did these thrive upon the slopes of the ravines and the faces of the bluffs, and many of them were of great size. They were cut down by the early settlers, many of whom would have starved to death, but for the friendly presence of the cedars and the buffalo bones, which it is said, they hauled to Hutchinson and sold. The deciduous trees include much the same species as occur in eastern Kansas, but less of cottonwood, while elm is particularly abundant.

Next month we shall give some account of the great gypsum deposit of the Dakota or Benton, which lies in Barber and Comanche Counties and which gives to Kansas another and very prominent "gypsiferous horizon" which has hitherto escaped the attention of our geologists; together with a brief notice of the great "Salt Well" of Ford County, notes on some striking relief-features of southern Kansas, and notes on its palæontology and natural history.

[*To be Continued.*]

MINERAL BELTS OF THE CONTINENT.

PROF. J. VAN CLEVE PHILLIPS.

Take one of our numerous continental railroad maps that shows the topography of the mountain system of Sierra Nevada, Sierra Madre and the basin between them, and draw a blue line from Alaska along the great watershed of the Rocky Mountains to San Luis Potosi in Old Mexico, and another line to follow the Sierra Nevada from Van Couver's Island to Zacatecas. Make these lines one-half inch wide with a camel's hair pencil. In the State of Zacatecas these mountains come together, and going south separate and form the vein of the basin in which the city of Mexico is located. Going farther south these watersheds again come together in the State of Ozaca, where silver and gold mines are found. The mountain range then narrows and runs single through Central America and the Isthmus of Panama.

The eastern belt crosses the Rio Grande where that river bends north and forms the Santa Rosa Mountain Range in the State of Coahuilla. Along this range a silver vein can be traced for 100 miles, and anthracite coal follows the silver half a mile distant to the east. What are known as the Santa Rosa silver mines are in this belt.

Going south this mountain terminates in round knobs from 500 to 1,000 feet high that form a mountain range to San Luis Potosi, where these belts bisect each other, and which explains the great silver veins worked by the Spaniards in the States of San Luis Potosi and Zacatecas.

The reader will now have in his mind's eye these two great silver streams, that reach from Behring Straits to the Isthmus of Panama.

The Sierra Nevada or Pacific Coast Range passes into Old Mexico in the State of Sonora, and following the coast forms the Cordillera or Andes of this continent.

Between these mountain ranges at the south is the high basin of the City of Mexico, coming north the Mexican Desert or Bolson de Mapimi, which at its north end forms the San Luis Valley, and farther north the basin of Utah, Arizona, New Mexico, Nevada, Oregon and Washington Territory, to Alaska.

The lines must follow the center of these great watersheds in their sinuous and serpentine courses, as they wind around at the heads of a thousand streams that flow east and west, and form the heads of great rivers of the continent.

A line on the west side of the Sierra Nevada, to follow the local watersheds and centers from which the streams radiate from Alaska through Oregon, California, Sonora to El Oro, in Durango, Mexico, and from there south to the Isthmus, covers the native gold and silver belt of the continent. This belt should be colored yellow.

In 1878, in going from Parral, Mexico, to Inde, a dry placer gold field was crossed seventy miles wide. El Oro is in the southern part of this field. The head waters of the Nueces and Sistine Rivers descend from the Cordillera, and run east; along the ribs of this chain the gold bearing quartz veins must be looked for. The country is black clay slate disrupted by granitoid rock, and in geology it is the duplicate of the California gold field.

There are evidently untold millions of dollars in the dry gulches of this gold field, and all that is needed is ditches to bring the water. Here is an opening for a large number of our floating mining population to invade industrially and peaceably our sister Republic. The climate is good, living cheap, and gold easy of access, to be worked by small parties with their individual labor.

This is one of the first steps for the native miner to study up practically ; the vein system of the silver and gold fields of Mexico. There are other Comstocks, Silver Kings, Veta Grandes, and native silver veins as found at Batipilos to be opened along these two belts and in the basins between them.

We now have in the mind's eye the silver and gold framework of these two mountain ranges, and now comes the embellishment of this topographical picture. Along the sides of these mountain ranges and in the great basin between them, are lesser drainage centers, marked by conic mountains that have their satellites or lesser conic hills around them. These stand as sentinels along the great continental divides, as the Black Hills, Pike's Peak, Leadville, Mount Davidson, and boofas as at Parral, Inde, and hundreds of others from the Canada line to the halls of the Montezumas. These outlying knobs are the fixed stars of this stellar

silver and gold belt. Each conic mountain and its secondary knob is a watershed for an individual family of gold and silver-bearing veins; but a small part of these stores of metal has yet been touched. This latent wealth is to form the banking capital of the people of the future. The backs of quartz veins and blossoms on them looked much the same when the pyramids of Egypt were being built as in A. D. 1500. Each atom of metal in these veins has been deposited with direct reference as to its drainage. The vein system was seen in the ideal by the great Architect, and each atom followed its elective affinity, discriminative power of attraction and bias, and laws that filled these atoms in the vein system and outlying centers and basins have their counterpart in the human mind. The geology of this vein system is now all written in the "great stone book;" nothing can be added or taken away, but only translated, and observing explorers, by a study of the topography, mineralogy, geology and vein system of these great belts and drainage centers, can locate the undeveloped Comstocks, Silver Kings, and Veta Grandes of the future.—*Mining World.*

WEST VIRGINIA'S TIN MINES.

It is not generally known that there are in successful operation in West Virginia two tin mines. One is near the city of Huntington, in Cabell County, and the other about five miles from Grantsville, in Calhoun County, on Laurel River. Unfortunately it is a considerable distance from a railroad and on very bad ground for hauling. The Calhoun County mine, which is the most extensive, is owned by State Senator T. J. Farnsworth, of Buckhannon, this State, and B. Ridgeway, of Staunton, Va. Two years ago all this land was regarded as comparatively valueless, except for the splendid timber, and was a slow sale at fifty cents an acre. The same property is now held at hundreds of thousands of dollars. The tin is practically inexhaustible. The opening of the mine is directly in the face of a great hill. The rock is extremely hard, and blasting and drilling are constantly necessary. The product is of a bluish gray color. Primitive machinery for the manipulation of the ore is in operation, and scores of curious visitors daily visit the place. P. B. Wilson, of Baltimore, assayed the ore, and found it to contain 42 per cent of tin. As soon as the necessary arrangements can be made smelting-works on an extensive scale will be erected. Eastern capitalists own the mine in Cabell County. It is believed that the Calhoun County vein extends miles across the country to the Great Kanawha River.

THE MEXICAN TIN FIELD.

The *Tribune* of Durango reports that about ninety miles northwest of that city and 125 miles from the station of Villa Lerdo, on the Mexican Central Railroad, is the small town of Coneto, with about 1,000 inhabitants, and situated in the center of the tin region of Mexico. It bears traces of having been much

larger in size and a very prosperous mining town. It lies in a gulch at the foot of a chain of mountains, called San Francisco, and its population derived and still derives its living chiefly from mining and smelting tin ores found in the above mountains. The San Francisco chain is one of the lateral branches of the main chain of Rocky Mountains, and is about 100 miles in length and from forty to sixty miles in width. Throughout its length and width it is a series of abrupt peaks, rocky cañons and some occasional grassy slopes and long but narrow valleys. The whole of it is heavily wooded with oak and pine, but is almost waterless, although during the rainy season many unfordable mountain torrents are met with there, and the grounds offer at many points facilities for damming, where a short dam, if built, would entrap an extensive reservoir or a series of reservoirs of water. Toward the southwestern end of this ridge is the central point of the Mexican tin region. Its extent is about 150 miles in length and about the same in width.

The tin ore found there is principally red and black cassiterite of extreme purity, and this is found either in veins which fissure in all directions these peaks and their slopes, or in placers, in gulches and valleys at the foot of the peaks and slopes. As the foot of all ridges and slopes where a vein exists, a placer of tin is invariably found. Sulphuret of tin, similar to Cornwall, England, tin stone, has also been found, but, so far, only in one point of these mountains; while arseniate of tin and also very finely divided red ophite of tin are met with in many of the numerous veins already tapped. The massive cassiterite is usually found in the veins in continuous streaks of various widths, the ore being, of course, easily separated from its gangue, and containing from 70 to 80 per cent of metallic tin. The veins are very numerous, and although many of them are cut into, and some have been worked quite extensively, it is a certainty that only a small percentage of them are known at present, and a great many more could be found by judicious prospecting.

PHYSICS.

ELECTRICITY AND MAGNETISM.[1]

PROF. FRANCIS E. NIPHER.

It was known six hundred years before Christ that when amber is rubbed it acquires the power of attracting light bodies. The Greek name for amber, *elektron*, was afterwards applied to the phenomenon. It was also known to the ancients that a certain kind of iron ore, first found at Magnesia, in Asia Minor, had the property of attracting iron. This phenomenon was called magnetism. This is

1 Introductory to the course of Lectures on Physics at Washington University, St. Louis Missouri.

the history of electricity and magnetism for two thousand years, during which these facts stood alone, like isolated mountain peaks, with summits touched and made visible by the morning sun, while the region surrounding and connecting them lay hidden and unexplored.

In fact it is only in more recent times that men could be found possessing the necessary mental qualities to insure success in physical investigation. Some of the ancients were acute observers, and made valuable observations in descriptive natural history. They also observed and described phenomena which they saw around them, although often in vague and mystical terms.

They, however, were greatly lacking in power to discriminate between the possible and the absurd, and so old wives' tales, acute speculations and truthful observations are strangely jumbled together. With rare exceptions they did not contrive new conditions to bring about phenomena which Nature did not spontaneously exhibit—they did not experiment. They attempted to solve the universe in their heads, and made little progress.

In mediæval times intellectual men were busy in trying to set each other right, and in disputing and arguing with those who believed themselves to be right. It was an era of intellectual pugilism, and nothing was done in physics. In fact, this frame of mind is imcompatible with any marked success in scientific work.

The physical investigator cannot take up his work in the spirit of controversy; for the phenomena and laws of Nature will not argue with him. He must come as a learner, and the true man of science is content to learn, is content to lay his results before his fellows, and is willing to profit by their criticisms. In so far as he permits himself to assume the mental attitude of one who defends a position, in so far does he reveal a grave disqualification for the most useful scientific work. Scientific truth needs no man's defense, but our individual statements of what we believe to be truth frequently need criticism. It is hardly necessary to remark also, that critics are of various degrees of excellence, and it seems that those in whom the habit of criticism has become chronic, are of comparatively little service to the world.

The great harbinger of the new era was Galileo. There had been prophets before him, and after him came a greater one—Newton. They did nothing of note in electricity and magnetism, but they were filled with the true spirit of science, they introduced proper and reasonable methods of investigation, and by their great ability and distinguished success, they have produced a revolution in the intellectual world. Other great men had also appeared, such as Leibnitz and Huyghens; and it became very clear that the methods of investigation which had borne such fruit in the days of Galileo, were not disposed of completely by his unwilling recantation; it became very clear that the new civilization which was dawning upon Europe, was not destined to the rude fate which had overwhelmed the brilliant scientific achievements of the Spanish Moors of a half century before.

Already in 1580, about the time when Galileo entered Pisa as a student, Borroughs had determined the variation of the magnetic needle at London, and

we have upon the screen a view of his instrument, which seems rude enough, in comparison with the elaborate apparatus of our times. The first great work on electricity and magnetism was the "De Magnete" of Gilbert, physician of Queen Elizabeth, published in 1600. Galileo, already famous in Europe, recognized in the methods of investigation used by Gilbert the ones which he had found so fruitful and wrote of him, "I extremely praise, admire and envy this author."

Gilbert made many interesting contributions to magnetism, which we shall notice in another lecture, and he also found that sulphur, glass, wax and other bodies share with amber the property of being electrified by friction. He concluded that many bodies could not be thus electrified. Gray, however, found in 1729 that these bodies were conductors of electricity, and his discoveries and experiments were explained and described to the president of the Royal Society while on his death bed, and only a few hours before his death. If precautions are taken to properly insulate conductors, all bodies which differ in any way, either in structure, in smoothness of surface, or even in temperature, are apparently electrified by friction. In all cases the friction also produces heat, and if the bodies rubbed are exactly alike, heat only is produced.

An electrified body will attract all light bodies. This gutta percha when rubbed with a cat's-skin attracts these bits of paper, and this pith-ball, and this copper ball; it moves this long lath balanced on its centre, and deflects this vertical jet of water into a beautiful curve.

If a conductor is to be electrified, it must be supported by bad conductors. This brass cylinder standing on a glass column has become electrified by friction with the cat's-skin. My assistant will stand upon this insulating stool, and by stroking his hand you will observe that with his other hand he can attract this suspended rod of wood, and you will hear a feeble spark when I apply my knuckle to his.

DuFay, of Paris, discovered what he called two kinds of electricity. He found that a glass rod rubbed with silk, will repel another glass rod similarly rubbed, but that the silk would attract a rubbed glass rod. We express the facts in the well-known law that like electricities repel each other, and unlike attract. For a long time the nature of the distinctions between the two electricities was not understood. It was found later that when the two bodies are rubbed together they become oppositely electrified, and that the two electricities are always generated in equal quantity; so that if the two bodies are held in contact after the rubbing has ceased the two electricities come together again and the electrical phenomena disappear. They have been added together and the result is zero. Franklin proposed to call these electricities positive and negative. These names are well chosen, but we do not know any reason why one should be called positive rather than the other. The electricity generated on glass when rubbed with silk is called positive.

Let us now examine the distinction between positive and negative electricities somewhat more closely, aiding ourselves by two cases which are somewhat analagous.

Two air-tight cylinders, A and B, contain air at ordinary pressure. The cylinders are connected by a tube containing an air-pump, in such a way that when the pump is worked, air is taken from A and forced into B. To use the language of the electricians, we at once generate two kinds of pressure. The vessels have acquired new properties. If we open a cock in the side of either vessel, we hear a hissing sound. If a light body is placed before the opening in A it would be attracted, and before the opening in B it would be repelled. Now this is only roughly analagous to the case of the electrified bodies, but the analogy will nevertheless aid us in our study. If the two vessels are first connected with the air, and then closed up and the pump is set to work, we increase the pressure in B and diminish the pressure in A. To do this requires the expenditure of a quantity of work. If the cylinders are connected by an open tube—a conductor—the difference in pressure disappears by reason of a flow of gas from one vessel to the other.

If we had a pump by means of which we could pump heat from one body into another, starting with two bodies at the same temperature, the temperature of one body would increase and that of the other would diminish. If we knew less than we do of heat we might well discuss whether the plus sign should be applied to the heat, or to the cold, because these names were coined by people who knew very little about the subject except that these bodies produce different sensations when they come in contact with the human body.

Furthermore, we find that whether the hand is applied to a very hot body, or to a very cold body, the physiological effect is the same. In each case the tissue is destroyed and a burn is produced. Shall we now say that this burn is produced by an unusual flow of heat from the hot body to the hand, or from the hand to the cold body, or shall we say that it is due to an unusual flow of cold from the cold body to the hand, or from the hand to the hot body?

Logically these expressions are identical; still we have come to prefer one of them. It is because we have learned that in those bodies which our fathers called hot, the particles are vibrating with greater energy than in cold bodies, that we prefer to say that heat is added and not cold subtracted, when a cold body becomes less cold.

Now to come back to our electrified bodies. Let us suppose that this gutta percha, and this cat's-skin are not electrified. That means that their electrical condition is the same as that of surrounding bodies. Let us also suppose that their thermal condition is the same as surrounding bodies, ourselves included—that is they are neither hot nor cold. We express these conditions in other words by saying that the bodies have the same electrical *potential*, and the same temperature.

Temperature in heat is analagous to potential in electricity. As soon as adjacent bodies are at different temperatures, we have the phenomena which reveal to us the existence of heat. As soon as adjacent bodies have different electrical potentials, we have the phenomena which reveal the existence of elec-

tricity. As soon as adjacent regions in the air are at different pressures, we have phenomena which reveal the existence of air.

Bodies all tend to preserve the same temperature and also the same electrical potential. Any disturbances in electrical equilibrium are much more quickly obliterated than in case of thermal equilibrium, and we therefore see less of electrical phenomena than of thermal. In thunder storms we see such disturbances, and with delicate instruments we find them going on continuously. Changes in temperature occurring on a large scale in our atmosphere, occurring in these gas jets, in our fires, in the axles of machinery and in thousands of other places, are so familiar that we have ceased to wonder at them.

If we rub these two bodies together, the potential of the two is no longer the same. We do not know which one has become greater, and in this respect our knowledge of electricity is less complete than of heat. We assume that the gutta percha has become negative. If we now leave these bodies in contact the potential of the cat's skin will diminish and that of the gutta percha will increase until they have again reached a common potential—that of the earth. As in the case of heat and cold, we may say either that this has come about by a flow of positive electricity from the cat's-skin to the gutta percha, or by a flow of negative electricity in the opposite direction, for these statements are identical.

In case of our gas cylinders, the gas tends to leak out of the vessel where the pressure is great, into the vessel where it is small. The heat tends to leak out of a body of high temperature into the colder one, or the cold tends to go in the opposite direction. Similarly, the plus electricity tends to flow from the body having a high potential to the body having a low potential, or, the minus electricity tends to go in the opposite direction.

FATIGUE OF METALS.

For fourteen years State Geologist Collett, of Indiana, has been experimenting upon a theory that the best of iron, when subjected to continuous strain, would undergo changes in its structure which would, after a time, render its use dangerous, and that these structural changes were the explanation of many otherwise inexplicably accidents, particularly to railway bridges. He has lately undertaken a systematic investigation, which has resulted in the confirmation of his theory. For experiment he took from the Wabash dam, at Delphi, a number of bolts and spikes, which were, when the dam was constructed, of the best quality of malleable bar iron, as is shown by the battering of the head when they were put into the structure. Of these bolts and spikes he found that seventy per cent of the whole number were as weak as cast iron, while ninety per cent of those which were near the bottom of the dam were worthless; yet of those which were rotten, the tips where inserted in immoveable rocks were fibrous and strong. When broken they showed polished ends to the connecting fibers, indicating that the continued vibrations of many years had polished and rounded the points of fibrous

structure. A similar effect is found in "the partings," or "horsebacks," in coal mines, which become polished and striated by the continuous quiver and motion of the crust of the earth.

Dr. Collett says that all car axles, after a reasonable run, become crystalized two-thirds of the length from the hub and one-third from the outside extremity, rendering them worthless. On one Indiana railroad bridge he found that the bottom parts of the vertical strain pieces were crystalized for from two to four feet in length, and, as a precaution against what would inevitably have caused a great catastrophe, they were replaced. The matter is one of great interest to railways, and the specimens which Dr. Collett has collected in his experiments are to be sent to the Stevens Institute of Technology, where an investigation of the subject has been in progress for years by a scientist connected with the Institute.—*Boston Journal of Commerce.*

HISTORY.

A PAPER ON NEW MEXICO.

FLORA ELLICE STEVENS.

I am tempted to write a slight sketch of the history of this new and yet old territory, not because I imagine that I am in any wise competent for such an attempt, for New Mexico has one of the most interesting pasts of any part of the Union, but that I would like her to have more of an audience in the recital of her history than she perhaps has had, and such an one the REVIEW furnishes me.

New Mexico is even to-day but semi-American; the laws are published in Spanish as well as English, four-fifths of the population speak the former—adulterated to be sure—the Pueblos, the Plazas, the old Spanish names yet linger, and, excepting perhaps Louisiana, she is the most foreign quarter of the United States.

Twenty-five years will radically alter this, the Senors Dorsey and Ingersoll with their Palo Blanco cattle companies are going to push out the Mexican, that is the Mexican as Mexican; but as yet the delightful romantic antique flavor hangs about her. One sees the remnant of the Pueblos casting their pottery in the ancient forms; the descendants of them who followed Cortez mingling with the fairer-countenanced Americanos.

When is mentioned in Mexican history the Indians, it is not the Indians as commonly denominated but the Pueblo aborigines that are considered, the ancient native race, or races, who were far above—in intelligence and civilization—the red men who bear their title. A few of their descendants still exist, dwelling in their pueblos in the ancient commune way. It is with these Indians, now

classed together as the Pueblo Indians, or more properly the Indians of the pueblos, that the history of New Mexico commences.

Cabeza de Vaca, the first European who visited New Mexican territory, found it in the possession of communities who were very different from the nomadic tribes further east, who lived in substantial houses, cultivated the soil, raised cattle, spun cotton, and were in many respects like the followers of Montezuma at the south. They were comparatively an oasis amid the desert of ignorant tribes that stretched about them either way. De Vaca had seen no grain throughout all Texas, but so soon as he reached New Mexico he found fields of corn, beans, pumpkins and calabasas; speaks of annole root used for soap, of the inhabitants wearing shoes of leather, etc.; certainly a creditable degree of civilization.

To-day, archæologically considered, the ancient races are generally classed together as Aztecs—so named from Aztlan, the country of the Gulf of California, from which the Aztecs came. In reality there were several tribes, the most important of which were the Toultecs or Toltecs, the Acolhues, and the Aztecs, who at different periods migrated from their old homes and settled in the fertile portions of what is now Mexico.

The Toltecs left their home in the northwest at Huehuetlapallan, in the year 1 Tecpatl, which is held by some to be 596, by some 594 A. D. They traveled southward for about a century, living a nomadic life, and remaining but a few years in a place. According to Ysidro R. Gondra they after these wanderings settled, and founded a city not far from the present site of Mexico named Tolam or Tula, which became the capital of their country.

Between these and the Acolhuans came the Chichimecas, who were more barbarous, and by some are supposed to be the cliff-dwellers, as they built no houses but lived in caves.

Afterwards came the Acolhues from Tinoacolhuacan, which was near Amaquemecan, the home of the Chichimecas. Their princes married the daughters of the king of the latter, Xolotl, and for a time ruled the Mexico country.

The Aztecs left Aztlan, according to Gondra, in 1064; to Baron Von Humboldt, 1038; to Clavigero, 1170. The latter omits in his accounts two Mexican centuries, or 104 years—a Mexican century consisting of fifty-two years—which probably accounts for the wide difference in the statements of the historians. Their journeyings were most interesting. They at length reached the Casas Grandes in Chihuahua, where is a large communistic building still remaining, three stories in height, with the entrance as in the New Mexico pueblos, on the second floor, which is reached as is theirs, by ladders.

The quite celebrated sheet of hieroglyphics mentioned by Careri represents the travels of the Aztecs from Aztlan to Chapultepec. It was a piece of maguey paper thirty-three inches by twenty-one. In hieroglyphics were depicted a flood, in which a dove was seen, but only one man and one woman were saved. Their march is described "from the place of flamingoes," "through the place of grottoes," etc.; till at length they arrived at Chapultepec in 1245, where the legend

says an eagle they saw perched upon a cactus—which is to-day the design upon the Mexican coat-of-arms—induced them to stop upon that spot and build their capital there.

It is presumed that New Mexico was settled by detachments from the Toltec and Aztec emigrations, who remained in the country and finally became isolated from their kindred, and at length were gradually surrounded by barbarous tribes, among whom they presented the curious picture of a semi-civilized race, losing, however, none of their thrift and intelligence, while preserving their ancient faith after the lapse of years.

Their traditions relate to their protection by Montezuma, who according to them taught them to build their terraced dwellings, estufas, and to keep burning the sacred fires. They called themselves the Children of the Sun, with which luminary Montezuma was held also to be identical. Montezuma, however, is not to be confounded with the king whom Cortez deposed, but was their God, their venerated mythical hero, the kings taking his title.

During all the changes in the governments of New Mexico the Pueblos have always conducted their own. Their principal officer is a cacique, who is elected for life, to whom all disputes are referred, and whose decisions are ever peaceably accepted. As Prince says "What gives special interest to the pueblo dwellings is that nowhere else on the continent are buildings inhabited precisely as they were when Columbus discovered America. In several instances, as at Taos and in the western pueblos, the people are living in identically the same houses that were then occupied."

When the Spaniards entered New Mexico there were four different tribes among these Indians, whose language was totally distinct, so that those of one pueblo could not understand the tongue of another, which, perhaps but twenty-five miles away, is belonging to another group; which is true of those existing to-day. The groups at the time of De Vaca were the Teguas, Queres, Piros, and Tanos. The Zuni and Jemez Indians are probably descendants of the Moqui. At the time of the settlement by the Europeans there was in these communities a population estimated by various writers as from 150,000 to 300,000 souls. One strange thing about the language of these tribes is that with the Teguas the words are principally monosyllabic, among the Ineres dissyllabic, while the others could only express the meaning of the commonest objects by words of astounding length. I quote from Prince this example of the word "earth." "In Queres it is *hah-ats*, in Tegua *nah*, in Piros *pah-han-nah*, in Jemez *dock-ah*, in Zuni *ou-lock-nam-nay*." The Tanos to-day are all extinct, but the Indians of the Jemez and Zuni tribes may be added, making five instead of the original four, each preserving its original tongue, and so unlike are they that the different pueblo nationalities when addressing one another use the Mexican *patois* for a common mode of speech.

To Alvah Nuñez Cabeza de Vaca, a Spaniard, belongs the honor of being undoubtedly the first white man to ever step upon New Mexico's territory. His

journey was so full of romantic and yet perilous adventures, that I regret I cannot within the limits of this article give an extended account of it.

De Vaca accompanies Narvaez in his expedition, which sailed from Spain June, 1527, the object of which was the discovery of new lands to be taken in the name of the King of Spain, the subjugation of the natives, and principally the discovery of gold and precious metals, the great aim of all the transatlantic adventurers of that time. Of this expedition De Vaca was appointed treasurer. When they arrived off the coast of Florida a number, including the Governor Narvaez and De Vaca, landed and commencing an inland journey—contrary, however, to the wishes of the latter—in search of provisions, of which they were growing scarce, and a better port of entrance for their ships, became separated from the others of whom they never heard further. After experiencing every form of privation, being reduced in numbers by death, and the separation consequent upon the dispersement of different expeditions which were never more heard of, De Vaca and two companions found themselves alone in a country of which they knew neither breadth nor length, among a hostile people. For six years they were held as slaves by the Indians, and subjected to every species of want and abuse. They had gradually wandered westward until at this stage they were probably in what is now Texas. By their superior knowledge of medicine, however, they were enabled to effect many cures among the Indians, and at length came to be looked upon with respect and reverence. They had now been absent from Spain over seven years.

De Vaca, who was the leading spirit had constantly in view the escaping and reaching the Spanish settlements in Mexico, which he presumed to be near. Therefore they were constantly stealing away from one tribe to another. They performed many cures, and did not neglect their religion, but baptized and blessed those who came to them for treatment, and so left for themselves a name among the Indians that Spaniards coming afterwards found held in high regard among the aboriginal traditions.

They traveled northwesterly, and it is comparatively easy to make out the first point where they reached New Mexico, from the narrative given by De Vaca himself to the Spanish king upon his return to his country. He speaks at this place of entering, a country of "settled habitations," undoubtedly the pueblos, which would at once strike the European as different from the tents of the nomadic tribes.

This was in 1535, which may be received as the date the first European entered on New Mexican soil.

De Vaca calls this the "cow nation," as they raised large herds of these animals, and speaks in his chronicle not merely enthusiastically of their civilized habits, and gives the minutiæ of the structure of their dwellings, but of their finer physical proportions and superior intelligence to other Indians.

De Vaca's history is so admirably accurate, and free from exaggeration that his route may be traced without much difficulty, the rivers and ranges named, even the very pueblos distinguished.

His reaching New Mexico seems to be the turning-point for his long and perilous wanderings; he was well treated by the Indians, and soon heard rumors of the Spaniards which led him to turn his steps south, and in 1536 to reach the goal of his hopes, with his companions, the City of Mexico; whence they embarked for Spain, which they gained ten years after the fated expedition had left it to conquer, as they fondly expected, a new country across the seas.

But Alvah Nuñez Cabeza de Vaca had won one title, which as she grows in wealth and fame will be one for history to value: i. e. *The first white man to step on New Mexico's soil.*

[*To be Continued.*]

THE UNITED STATES AS IT WAS IN 1780; AS IT IS IN 1880; AND WHAT IT WILL BE IN 1980.

E. A. HICKMAN.

There is no problem likely to be presented to the statesmanship of our country in the next century, that requires as much deep analyzing wisdom as the one that demands homes and employment for the young men and women who are forming so vast a proportion of our population. To see this subject as it advances and increases in importance and magnitude we must look into the past and present, and from them anticipate the future.

I will give the population of the United States in 1780 and at the various decades since, with the per cent of increase in each period of ten years:

	Population.	Gain, per cent.
1780	3,070,000	
1790	3,930,000	28
1800	5,308,000	35
1810	7,240,000	33.4
1820	9,659,000	33.2
1830	12,866,000	32.6
1840	17,069,000	35.8
1850	23,192,000	35.6
1860	31,443,000	24
1870	38,978,000	34.3
1880	50,156,000	30

In the century past the population has increased at an average of 33 per cent compounded every decade. In that century, too, that population had hardships and impediments to surmount that may not impede progress or delay the increase of the next. In that century, the active and inventive mind of the American mechanics and scientists has invented, and constructed, and patented 312,000 improvements on the old order of things, that the burthens and labors of

life may be less oppressive; and of these all shops, farms, offices, stores, mills, boats, and railroads bear valuable fruits, and these classes of our citizenship have removed many hardships and privations; and those common to the beginning of the period mentioned, are unknown to those who live in the later years.

In the beginning of that period, and from that on till now, the United States Government has had a vast domain of public lands for all who wanted farms; and liberal provisions were granted to every one who chose to locate on vacant land. Thus from any over-crowded locality the excess simply flowed into this vast territory of unimproved land, and in a few years where there had been apparently a barren waste, there sprang up States with all the necessary functions of like governments a hundred years older.

To-day the area of the United States is. . . .	3,110,061
square miles exclusive of the Indian Territory.	70,600
And of Alaska	720,000

This first area will equal a square whose sides are 1,764 miles long. This extensive expanse has been nearly all taken up by private individuals, and but little more is left for the pioneer.

What is now before the statesmen of our country for their prime consideration? It is this: How shall the vast increase of our next century (if it be in proportion to the last in per cent) be supplied with homes and honest employment? These are necessary to the individual and the family; to hold them up in self-respect, and keep them on an elevated plane of citizenship where childhood and youth can be reared into maturity, pure, noble, and grand, as God wanted *Man* to be; then with the *will* to labor, and the *place* to labor, he can go on in obedience to the Divine Command and live, and grow in mind and morals and perfect himself. How much space *per capita* will the ending of the next century demand?

The 3,070,000 population of 1780 has grown in one hundred years to 50,156,000 and has extended from the confines of the thirteen Atlantic States containing an area of 800,000 square miles to one of 3,110,061 miles, and embracing thirty-eight States and seven territories, all politically organized to furnish their citizens with the benefits of civil government and such guarantees as will enable families to rear their children with judicious efforts to honorable and respectable man and womanhood. Then if the 3,070,000 population of 1780 make an increase to 50,156,000 in a century, that last number in the next century will reach at the same ratio of increase 852,000,000 of people.

What provisions must be made for this enormous population? It must be supplied with honest respectable labor to keep it above the ruinous sinks of vice, and to supply food, raiment and house-room. How can that labor be applied to supply these necessaries?

In the various manufacturing departments now in operation by the use of the improved machinery before alluded to, an over-supply is now on the market,

and dealers say there is but little profit in their trade. The farmer complains that his productions do not pay interest on his investment and for his labor.

The mechanic says his labor during the summer and fall months does not supply him with funds to sustain his wife and children during the idle days of winter, and the day laborer often suffers for the necessaries of life when summer and fall work has past. If that be the condition of our population of to-day, what must it be a hundred years hence?

American citizenship of the nineteenth century is unlike the social condition of any former populace known to history. In other periods that have gone, there was an alliance demanded by the land-owner, and granted by the plebian, who felt his inferiority because he was not an owner of land, and subject to the will of him who was.

A widely different state of things exists here; in the hundred years past, American thought, American character, American freedom, all have been cultivated into an unity, and become an object which so many of the rising generation are seeking to attain.

It is this freedom,—this effort to rise,—this persistent and logical thought of the young and laboring classes that have given our government some of its wisest and best men. Our great systems of internal improvements have been built by the capital made by the energies of the country-raised boyhood, and some of the finest works of civil engineering are from the same class, and inventions that have revolutionized the commerce and civilization of the world have grown out of the same class of mind. Nothing so loudly proclaims the value of boyhood effort as the successes that have rewarded many citizens in every community.

But these vast demands for skill, and energy, and capital are ceasing. The railroads have been built; the streams have been bridged, the saw-mills have been constructed and worked up the forests into lumber; the flouring-mills are more than able to grind up the wheat production. The towns and cities have an over-supply of dealers in all branches of trade. The farmers are all supplied with buildings, and that most profitable and useful class of works known as agricultural machinery has supplied all previous necessities, and there is enough left to furnish the future demand for five years. Where now, with all demands supplied and enterprises comparatively finished, must the young men and women look for such work as will supply the wants of life and give such vitalizing influences to the germs of true greatness, as will elevate them above the degrading effects of idleness?

This freedom of American thought has in so short a time, worked such wonderful results and created such vast supplies, that it has to stop and ask "What must I do next?" Cannot some man of broad, perceptive thoughts rise and answer the enquiry, before the problem becomes entangled with other issues?

INDEPENDENCE, MO., February 25, 1885.

THE RENAISSANCE IN ITALY.

WILLIAM SHIELDS LISCOMB.

The fervor which had previously been felt by individuals now permeated society. A sense of the importance of culture took complete possession of Italy. It had come slowly and uncertainly, as a morning beset with clouds, in which the contest between light and darkness seems for a time doubtful. Yet men, peering across the sea on whose borders they had so long been wandering, saw the mists begin to lift, and at length descried the farther shore. Enchanted by the vision which, like some magnificent mirage, arose before their gaze, they stood for a moment spellbound; then reverently knelt to pay their adoration and offer their gifts at the cradle of this new-born redemption for the race. The conviction pervaded all classes that antiquity alone had power to rescue the world from the evils with which it had been so hopelessly struggling. "Like islands of safety in the midst of the universal deluge," says Grimm, "the ideas of the great minds of the past emerged; in the general confusion men fled to them for refuge." In city after city the flame of enthusiasm burst forth. Youths forsook the warehouse and the tavern to consecrate themselves to learning. Merchants stole away from their counting-rooms to converse with literary friends, or listen to the lectures of eminent professors. Captains of adventure read Virgil and Livy by the camp-fire, or in the pauses of the march. Noble ladies fled from the *ennui* of seclusion, and exchanged the trivial gossip of courts for the priceless treasures of knowledge. Princes spent fabulous sums in the patronage of humanists, artists, and authors. Peasants sought for their sons a place in the republic of letters, where genius was everywhere acknowledged as the peer of birth. The leaders of the *demi-monde* applied themselves to the poetry, rhetoric, and philosophy of Rome, in order to acquire that development and elegance of taste which should fit them, like Leontium and Glycera of Athens and Diotima of Mantinea, for companionship with the wits and thinkers of their time. Municipalities furnished employment to skillful Latinists as secretaries, chancellors, and ambassadors.

Popes vied with sovereigns in encouraging and promoting the very things which their predecessors had denounced as damnable. The Medici and other great Florentines directed their correspondents to purchase relics of antiquity at any price, and their ships came home laden not only with costly merchandise, but with precious codices, busts, statues, reliefs, and other objects of virtu. Niccolò Niccoli sat at a table with his friends, discussing the questions then uppermost in every mind, and eating from fair antique vases, while his house was literally packed with inscriptions, coins, marbles, and engraved gems, purchased without regard to cost, or sent him as gifts by those who knew his love of such things. The learned rejected their own names in the vulgar tongue, and assumed Latin titles instead. Pagan writers were quoted in the pulpit on an equality with the Fathers of the church, and at length, in the estimate even of high eccle

siastics, were set far above them. "Give up those trivialities," wrote Cardinal Bembo to Sadoleto, in allusion to the Epistles of St. Paul, "for such inelegancies are unworthy a man of dignity," *Omitte has nugas, non enim decent gravem virum tales ineptiæ.* The coins of Mantua were marked with the head of Virgil. Pius II. granted amnesty to the inhabitants of Arpino because it was the birthplace of Cicero, and Alphonso the Magnanimous forbade his engineers to trespass on the site of the orator's villa at Gaeta. Pomponio Leto delighted in leading the life of a Roman sage; tilling his ground in a manner described by Varro and Columella; eating his frugal meals, like a veritable Stoic, beneath the branches of an oak tree on the Campagna; and directing that after his death his body should be placed in a sarcophagus on the Appian Way, amid the tombs of the republican and imperial age. The class-rooms of professors were crowded to overflowing with pupils from every grade in life, eager to catch each word that fell from the teacher's lips. The palaces of wealthy citizens were thrown open to the disciples of erudition, and in them assembled those brilliant coteries of scholars whose discussions of ancient authors gradually unlocked the secrets of the past, and made them accessible to all mankind. The scenes which were presented on occasions like these must ever possess an indescribable charm. As the modern traveler stands in the magnificent gardens of Careggi, overlooking Florence, with the Arno stealing silently away to lose itself in the purple Mediterranean, the prospect of beauty before him vanishes like some lovely dream, and in its place return those morning hours of newly awakened intellectual life, when Lorenzo, "the sure anchor of the storm-tossed muses," gathered the members of the Platonic academy about him, and spent the long hours of the afternoon in drinking deep from that pure fount of truth, whose waters have refreshed the thirst of great spirits in every age. Then, when their minds had become wearied by concentration, they seated themselves about the board of their munificent host; rising from it to wander forth among the acacias, rose trees and laurels, while the air of evening, loaded with the perfume of countless flowers, fanned their temples back to coolness, and the calm stillness of the Italian twilight stole over the landscape, whispering to them each its message of peace. Strolling thus amid the garden beds, and communing with each other's thoughts, while day slowly vanished from the sky and the silent stars came forth one by one above them, with the lights of Florence twinkling in the distance and the Apennines and the mountains of Carrara sleeping in the east and west, what emotions must have thrilled their souls, what visions have been caught sight of, what hopes, aspirations, and high resolves have been theirs, as this new consciousness of power was awakened within their breasts! What wonder is it that these men were able so to impress themselves upon their generation; that Politian could tune his lyre to the language of the three great nations; that Pico della Mirandola, at the early age of twenty-three, should have proposed his famous nine hundred theses at Rome, offering to dispute with all comers on any subject in the entire domain of knowledge; that Michael Angelo, even, should have produced the Moses and the Sistine Chapel, or have sculptured those wonderful figures which sleep the centuries away on the Medicean tombs!—*February Atlantic.*

ASTRONOMY.

WHAT WERE THEY?

LOUIS WATSON, M. D.

On the morning of January 20, 1865, the Second Division of the 14th Army Corps, under the command of General Jas. D. Morgan, left Savannah on the march toward Richmond. About 8:00 o'clock on that morning when in the act of mounting my horse to accompany the General, as usual upon a movement as one of his staff officers, I observed upon the Sun, at that time through an elevated fog appearing as a deep red disk, two round black spots. They were near together, one much larger than the other, the lesser one as large as Venus appeared to my naked eye in its last transit, the larger one of triple or quadruple diameter. I lingered two or three minutes to observe them, then moved on with the Sun behind me. That day and the three following days proved cloudy and more or less rainy, the Sun not again becoming visible until a clear day on the 24th. No smoked glass, nor a substitute for one being convenient, I made no further observation. If these objects were "sun-spots"—at the time I imagined them to be nothing else—I very well knew that they were *remarkably* large ones, and from the duration of their presence as "sun-spots" that they could not escape the observation of astronomers and I confidently expected that after leaving the service I should meet with some account of them. In this anticipation I have been disappointed. In 1879 at a neighbor's house I picked up Tice's almanac for that year and among other matter I read what he had to say about "Vulcan" and its satellite. This article recalled my observation at Savannah and I wrote to Mr. Tice giving him an account of it and inquired if what I had seen could possibly be a transit of his "Vulcan." The following in his reply *verbatim et literatim*, but the words within brackets correcting an obvious error, are mine:

ST. LOUIS, MO., October 4, 1879.

DR. LOUIS WATSON, ELLIS, KANSAS.

DEAR SIR:—"Yours of 1st inst. received. It would puzzle me to account 'for the black round spots observed by you in Jan'y, 1865, if I had not arrived 'at the conclusion and published it long ago that there were two principal inter-'mercurial planets attended with satellites, that they were one-half of a revolu-'tion apart and revolved in the same period, 23,026 days. One's orbit seems to 'make about 14° with the Ecliptic (which is the one I saw) and the other about '76° (which you saw). If you saw it on the 20th of January then it intersected '[the plane of] the earth's orbit in 120° heliocentric longitude where the earth

'was on that day. My Vulcan I find on that day was at 301° heliocentric long-
'itude or ½ revolution plus 1° from yours. It is only to be regretted that you
'did not make observations to see whether it moved and what was the direction
'of its motion, probably at its descending node, as it was seen at its ascending
'node again with a companion on 20th July, 1876. Now the earth is at 302°
'heliocentric longitude on July 20th. 1876, was a leap-year, hence on that day
'in that year it was 301°, or just half a revolution plus 1° from where you saw
'it. This observation was made in California with the naked eye as I under-
'stand yours to have been. I write in a great hurry, as I am closing up some
'scientific matter before leaving for Wisconsin and Iowa. I am very thankful
'to you for the information.

Respectfully, JOHN H. TICE."

I had no further correspondence with Mr. Tice, and I do not know whether or not he ever published the facts I gave him. If Mr. Tice's statements in the above letter are *true*, there appears to me to be a coincidence worthy of notice. At any rate I feel that my observation, as short and imperfect as it was, should go upon record *somewhere*. My statement of the time when, place where, and circumstances under which I saw the objects mentioned, *is true*. The question is, What were they?

NOTE.—Having been requested by Dr. Watson to submit the above article to some experienced astronomer, we sent it to Prof. C. W. Pritchett, of Morrison Observatory at Glasgow, Mo., who replied as follows:

EDITOR REVIEW:—On this correspondence I can afford but a few brief notes

First. So far as I am informed, there were no *remarkable* Sun-spots in January, 1865. Surely they would have been *remarkable*, for *two* of them to be seen at *once* with the unassisted eye. Had they continued several days, they could not have escaped the attention of astronomers in some parts of the world. The veteran observer Schwabe, of Dessau, devoted a long life solely to the observation of Sun-spots. He observed the Sun on 307 days of 1865; and found but twenty-five days on which the Sun was entirely free from spots; but they were small groups, and entirely telescopic. Had these spots been *sudden* and *transient* outbursts of solar activity, even though they escaped detection on the Sun's disc, it is not probable that they would have been unattended by very marked magnetic and auroral displays—such as attended the great spots, at their rupture in April and September, 1882. It now seems to be well ascertained, that magnetic storms and remarkable auroras are always counted, in time at least, with disturbances on the Sun. I am tempted to cite numerous instances, but forbear.

Second. It is entirely improbable that the phenomenon was a transit of intra-mercurial planets. If such planets exist, it is quite certain they are much smaller bodies than Mercury; and it requires *preparation*, *effort* and *close scrutiny* to detect Mercury with the naked eye, on the Sun's disc, even when we know he is projected there. It is quite improbable that the *unaided eye* would ever have

detected Mercury or Venus when in Transit if the theory of planetary motion had not led us to *look* for them there, at certain times. As to the probable *existence* of Vulcan, I beg leave to quote a paragraph or two from Prof. Holden's Report on the great Solar Eclipse of May 6, 1883, observed at Caroline Island, S. Pacific Ocean. The report is published under the auspices of the National Academy of Sciences:

"At the eclipse of 1878 it was a question whether the planet *Vulcan* of Le Verrier existed or no. At the eclipse of that year, I searched for such a planet over a space of 320 square degrees and found none." I may add, that Prof. Asaph Hall, myself and others, all searched for it, with the same result.

Prof. Holden continues: "At the same eclipse, Prof. Watson reported the existence of two new and much smaller bodies which he saw with a four-inch telescope and a magnifying power of forty-five. Prof. Swift also reported the existence of two different (and new) bodies. At the *present eclipse* I looked for these with a magnifying power purposely chosen the same as Prof. Watson's and with an objective giving more than twice the light of a four-inch. No such new bodies existed within the space marked on the map (See *Science*, No. 3, February, 1883). It is my opinion, therefore, that at future eclipses, it will not be necessary to devote an observer and a telescope to the further prosecution of this search, and I must regard the fact of the *non-existence* of Vulcan as definitely settled by Dr. Palisa's (Imperial Observatory, Vienna,) observations and my own." Page 101, Memoir.

Third. Dr. Watson tells us he lingered but a short time to observe them, and then moved on, riding with his back to the Sun. With all deference, I think the statement leaves abundant room for the play of "optical illusion." There are conditions of the eye and the atmosphere, which make this entirely possible, even in despite of our own conviction to the contrary. Some persons always see an *intensely black spot* at the center of the headlight of a locomotive, two miles away. The most learned and careful astronomers now living have sometimes for years been imposed on by optical illusions. They are by no means uncommon. Sometimes the cause is purely *subjective*, at other times there is some *objective* reality arising out of the laws of refraction, reflection and dispersion of light. It is well known that Le Verrier's elements of Vulcan's Orbit, were founded on the rough observations of a French physician, Lescarbault. Yet M. Liais asserts that he observed the Sun at the identical time of Lescarbault's observations, and with *much better instruments*, and he is positive that no "black spot" was visible. This is one instance of many. But granting that "two round black spots" were really seen by Dr. Watson for a few moments, it may have been the *transient* interposition of objects comparatively *near the earth*—stationary and dense fragments of cloud, (and he says he saw the Sun through clouds)—large and distant birds in poise, or even meteorites, moving for a few moments in the line of sight to the Sun. But conjecture is useless, and so I desist.

C. W. PRITCHETT.

GLASGOW, MO., March 11, 1885.

SUN AND PLANETS FOR APRIL, 1885.

W. DAWSON, SPICELAND, IND.

Having passed the Vernal Equinox, the starting point of R. A., the Sun begins another course of the 24-hour circle; and on April 1st has gone just three-fourths through the first hour, and has attained a north declination of 4° 48′; when it rises six hours and sixteen minutes before southing, and sets six hours sixteen minutes after—making the day twelve hours thirty-two minutes long—in 40° N. latitude. At the end of April the Sun's R. A. will be 2h. 32m.; and declination 14° 58′ N. At this declination the Sun (or any other celestial body) rises 6h. 52m. before southing, and sets as much after; making its time above the horizon 13h. 44m.

The eclipse of March 16th was partially observed here. It began at 11:04, S. M. T., or 10:45 R. R. Time, 90th Meridian. In two or three minutes it made a grandly curious notch in the west side of the Sun. Mountain protuberances on the Moon's edge were quite prominent. For ten or fifteen minutes it seemed to move almost directly eastward as if the eclipse would be nearly, or quite annular here; but it passed upward and northward and left the Sun's edge a little eastward of the north point, about two or three minutes before two o'clock, but the last contact was obscured by clouds. At 1:55 there was quite a visible notch, but it was entirely gone at 1:59. Clouds prevented seeing a transit of the Moon's edge over a good sized spot near the lower edge of the Sun; but a small spot just to the left was hid at 11:33. Contact with the large spot above centre occurred at 11:44; and a small one about half way from this to the lower edge, twenty seconds earlier. The next smaller spot at upper end of the group was in contact at 11:48. Dense clouds soon came over and prevailed until 12:50, when it thinned just enough to get a good view without shade-glass. The black Moon now appeared in the *upper side* of the Sun, obscuring near half its diameter. It soon rose above the large group of spots, and in a short time everything was again hid by clouds; and the eclipse not seen much more; though enough to get nearly the time of ending—to learn that it lasted two hours and about fifty-four minutes.

The planet Mercury will be "Evening Star" all the fore part of April—coming to greatest elongation east (19° 26′) in the morning of the 8th, when its declination is nearly 17° N., which at this time of year is a position quite favorable for observation. It will set several degrees north of the sun-set point. Venus is still Morning Star, but too near the Sun to be well seen.

Mars is also Morning Star and near Venus, hence of no interest for observation. Jupiter is still a very prominent evening star high up in the eastern sky; southing at 9:14 P. M. on the 1st. and setting at 4:00 o'clock next morning. Its proximity to Regulus, n the south end of the Sickle gives a beauty to both. Saturn is high in the western sky, setting near midnight on the 1st of April, and

at 10:00 P. M. on the 31st. It is some distance east of Aldebaran in the Hyades group, and may be readily known by its bright silvery luster. The third magnitude star southeast of it is Zeta Tauri, and the brighter one north Beta Tauri. Now is the time to get a last look at the widest phase of its rings for nearly fifteen years.

RECENT ASTRONOMICAL DISCOVERIES.

A cable message from Dr. Krueger, received on March 7th, announces the discovery of an asteroid by Borelli.

March 6d. 8h. 45m. 36s. Greenwich M. T.
R. A. 11h. 6m. 13.5s. Decl. Plus 7° 9′ 17″
Daily Motion in R. A. —48s.; in Decl. plus 9′.
Eleventh magnitude.

A cable message from Dr. Krueger, received on March 10th, announces the probable discovery of Pogson's lost planet, by Dr. Palisa.

March 9d. 8h. 28m. 45s. Greenwich M. T.
R. A. 6h. 44m. 41.7s. Decl. Plus 28° 10′ 1″

A cable message from Dr. Copeland, at Dun Echt, received March 14th, announces the observation of a suspicious object by Dr. Gautier (of Geneva), which may be a return of Comet 1867 II. (Temple). A request was made for observations by American astronomers, and the following finding ephemeris was included in the message:

Gr. Midnight.	R. A. H.	R. A. M.	R. A. S.	Decl. °	Decl. ′	Light.
March 13	12	11	40	Plus 17	45	0.20
17	12	8	28	18	5	
21	12	5	8	18	24	
24	12	1	48	Plus 18	38	0.21

—*Science Observer Special Circular No. 56.*

ARCHÆOLOGY.

PREHISTORIC MAN IN EGYPT AND SYRIA.

A gala Meeting was held by the Victoria Philosophic al I
some time since at which its members gave a worthy welcome to Vice-Chancellor Dawson, C.M.G., of McGill University, Montreal, at whose instance the British

Association visited Canada this year. The Society of Arts kindly lent its premises for the occasion, and its great theatre was crowded in every part long before the hour of meeting. The chair was taken by Sir H. Barkly, G.C.M.G., K.C.B., F.R.S.,—who after the new members had been announced by Captain F. Petrie, the secretary—welcomed Dr. Dawson amid loud applause, and asked him to deliver his address: It was on "Prehistoric Man in Egypt and Syria," and was illustrated by large diagrams, also flint implements and bones collected by Dr. Dawson himself on the spot during his winter tour in the east; Professor Boyd-Dawkins, F.R.S., kindly assisted in the classification of the bones. In dealing with his subject, Dr. Dawson remarked that, great interest attaches to any remains which, in countries historically so old, may indicate the residence of man before the dawn of history. In Egypt, nodules of flint are very abundant in the Eocene limestones, and, where these have been wasted away, remain on the surface. In many places there is good evidence that the flint thus to be found everywhere has been, and still is, used for the manufacture of flakes, knives and other implements. These, as is well known, were used for many purposes by the ancient Egyptians, and in modern times gun-flints and strike-lights still continue to be made. The *débris* of worked flints found on the surface is thus of little value as an indication of any flint-folk preceding the old Egyptians. It would be otherwise if flint implements could be found in the older gravels of the country. Some of these are of Pleistocene age, and belong to a period of partial submergence of the Nile Valley. Flint implements had been alleged to be found in these gravels, but there seemed to be no good evidence to prove that they are other than the chips broken by mechanical violence in the removal of the gravel by torrential action. In the Lebanon, numerous caverns exist. These were divided into two classes, with reference to their origin; some being water caves or tunnels of subterranean rivers, others sea caves, excavated by the waves when the country was at a lower level than at present. Both kinds have been occupied by man, and some of them undoubtedly at a time anterior to the Phœnician occupation of the country, and even at a time when the animal inhabitants and geographical features of the region were different from those of the present day. They were thus of various ages, ranging from the post-Glacial or Antediluvian period to the time of the Phœnician occupation. Dr. Dawson then remarked that many geologists in these days had an aversion to using the word "Antidiluvian," on account of the nature of the work which, in years now gone by, unlearned people had attributed to the Flood described in Scripture, but as the aversion to the use of that word was, he thought, not called for in these days, he hoped it would pass away.

Speaking as a geologist, from a purely geological point of view, and from a thorough examination of the country around, there was no doubt but what there was conclusive evidence that between the time of the first occupation of these caves by men—and they were men of a splendid physique—and the appearance of the early Phœnician inhabitants of the land, there had been a vast submergence of land, and a great catastrophe, aye, a stupendous one, in which even the Mediterranean had been altered from a small sea to its present size. In illustra-

tion of this, the caverns at the Pass of Nahr-el-Kelb and at Ant Elias were described in some detail, and also, in connection with these, the occurrence of flint implements on the surface of modern sandstones at the Cape or Ras near Beyrout; these last were probably of much less antiquity than those of the more ancient caverns. A discussion ensued, which was taken part in by a number of distinguished Fellows of the Royal Society, including Sir H. Barkly, F.R.S., Professors Wiltshire, F.R.S., Warrington Smyth, F.R.S., Rupert Jones, F.R.S.; Colonel Herschel, F.R.S., the talented son of the late Sir John Herschel; Dr. Rae, F.R.S., the Arctic explorer; Dr. Dawson, F.R.S.; Mr. D. Howard, the Vice-President of the Chemical Institute, and other geologists. The meeting afterwards adjourned to the Museum whese refreshments were served.

THE USE OF COPPER IMPLEMENTS BY THE AMERICAN ABORIGINES.

PROFESSOR WRIGHT.

The interest with which we contemplate the work of the mound-builders is greatly enhanced by reflection upon the rudeness of their tools and the simplicity of their mechanical contrivances. There is no evidence that the original inhabitants of America had any knowledge of iron, or that they knew how to manufacture bronze. Ornaments of silver and gold were abundant in Mexico and South America, but neither of these valuable metals is available for tools. Copper was distributed over the whole of North America; and, while used extensively for ornaments, was only occasionally manufactured into implements; and, indeed, copper is not hard enough either to make a good edged-tool or a hammer. Hence at the time of its discovery by Columbus, America was still in the stone age, and stone implements everywhere marked the haunts of the aboriginal inhabitants; and the implements found in the most elaborate earthworks of the mound-builders are not superior in design or workmanship to those which mark the camping-places of the roving tribes.

Copper was, as we have said, widely disseminated among the aborigines of America, being found in almost every place where there are any prehistoric remains, from the lake to the Gulf of Mexico, and from the Atlantic Coast to the Mississippi and beyond. It was occasionally wrought into axes, chisels, gravers, knives, arrow-points and spears, but its principal use was for ornaments. Prof. Putnam has shown that the ancient copper implements of the United States have all been manufactured by hammering, proving that the natives did not under- the art of casting. In South America, however, copper has been found contain- taining the impress of the molds in which it was cast. The copper bracelets and beads so often found in the mounds were made from thin plates of the metal which had been hammered into shape and then bent over a string.

The source from which copper implements and ornaments have been derived

is, without much doubt, on the northern peninsula of Michigan, near where mining is carried on so extensively at the present time. Native copper is occasionally found in the valley of the Connecticut River and in New Jersey, but in quantities too small to have furnished even the supply which we know to have been in possession of the aborigines of New England. On Keweenaw Point, however, in Northern Michigan, not only is there an endless amount of native pure copper which savages could use without melting, but there are numberless excavations made by natives in searching for the metal before historic times.

This portion of Michigan lay in the track of the great ice-movement which characterized the glacial period. By this means boulders were transported from this region as far as the southern parts of Ohio, Indiana, and Illinois. I have, indeed, found boulders (though none containing copper) from the vicinity of these mines which had been carried by the ice to the Kentucky hills, a few miles south of Cincinnati. It is not surprising, therefore, that occasionally masses of this copper should be found in connection with the gigantic boulders which had been transported by ice to the vicinity of the mounds in the Ohio Valley. A piece of Lake Superior copper weighing five or six pounds was found by Prof. Brainard, of Cleveland, in the glacial deposits of Medina County, O. Dr. John Locke, of Cincinnati, reports in his possession "a flattened piece of copper, weighing several pounds, which was found in the earthworks at Colerain, Hamilton County, O., having a spot of silver as large as a pea forming part of the mass." The presence of silver in such form is pretty positive evidence that the mineral came from Lake Superior, as it is not known to exist in this condition in any other mines.

Considering the rude tools with which the prehistoric miners of Northern Michigan were compelled to work, their operations were really very surprising. Their mauls were nothing but pebbles from the beach, grooved for withes, which they used as handles. With these rude implements they broke away the rocky portion of the vein containing the copper, and dug trenches, in some places ten feet deep, and extending a long distance. Occasionally they encountered a mass of copper too large for them to manage; and after working upon it ineffectually for a long time, left it surrounded with their tools and crude mechanical contrivances, to tell the story of their disappointment.

Near Copper Falls, according to Col. Whittlesey, there was discovered in 1854, a prehistoric trench, dug in the solid rock to a depth of ten feet and following the copper veins for thirty feet. From the bottom of the trench in one place a flat piece of copper, from five to eight inches thick, was found to project upwards for eighteen inches, the granite upon each side having been removed by stone hammers to that depth. The upper edge of the copper "had been beaten by the stone mauls so severely that a lip, or projecting rim had been formed, which is bent downward over the sides. A large number of broken mauls were found in the place, and around it on the surface." It is not surprising that the efforts of these ancient miners were ineffectual in the present instance, as this mass of copper proved to be about nine feet in length, being,

therefore, still imbedded, and when they left it seven feet below the rocky bottom of their trench. There are neither marks of a cutting tool nor of fire upon these masses of copper.

At the Minnesota mine in the vicinity of Ontonagon River, a group of rude ancient trenches shows the position of the copper vein for more than two miles, and the excavations are some of thirty feet in depth. In one of these there was found when first discovered, in 1847, a detached mass of copper weighing nearly eight tons, which lay "upon a cob-work of round logs, or skids, six to eight inches in diameter, the ends of which showed plainly the stroke of a small ax or cutting-tool, about two and a half inches wide." These skids were of oak, and, on drying, shrank and cracked as water-soaked timber which has been long buried, is sure to do, and possessed little strength. "The mass of copper had been raised several feet on the timbers by means of wedges." "Its upper surface and edges were beaten and pounded smooth, all the irregularities taken off, and around the outside a rim or lip was formed, bending downwards." Charcoal and ashes were found in all these trenches. One of the stone mauls from this vicinity weighed thirty-six pounds, and was provided with a double groove, being, doubtless, intended to be used by two men.

In one of the pits a rude ladder was found, formed of an oak tree trimmed so as to leave the stumps of the branches projecting, on which men could readily descend or ascend to or from their work. Wooden levers were also found among the rubbish, preserved by the water, which covered them continually. On the edge of the excavation in which the mass of copper described was found, there stood an aged hemlock, the roots of which extended across the ditch. I (Colonel Whittlesey) counted the rings of annual growth on its stump, and found them to be 290. Mr. Knapp mentions another tree which had 395. The fallen and decayed trunks of trees of a previous generation were seen lying across the pits.

According to Mr. Foster, the number of ancient hammers taken from these excavations alone exceed ten cart-loads.

"In cleaning out one of these pits the workmen came upon the remains of a wooden bowl, which, it was inferred from the splintery fragments of rock imbedded in the rim, must have been employed in baling out water." From the uniformity with which marks of fire are found in these trenches, it is plausibly inferred that the rock vein was heated, and water dashed upon it to destroy its cohesion, and make it crumble more easily under the blows of the rude mauls wielded by the ancient miners. "This method was practiced by civilized nations before the invention of gunpowder, and is even at this day in the mining districts of the Hartz and Altenberg." At Isle Royale, on Lake Michigan, some of the ancient mining pits are fifty feet in depth, and according to Foster and Whitney, there is scarcely a productive vein in all the copper region that does not give evidence of having been worked in prehistoric times.—*Chicago Advance.*

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Feb. 20th to 28th.	Mar. 1st to 10th.	Mar. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	10.	25.	14.	16.
Max	53.	70.	70.	64.
Min. and Max	31.	48.	42.	40.
Range	43.	45.	56.	45.
TRI-DAILY OBSERVATIONS.				
7 a. m.	18 6	31.2	33.0	27.6
2 p. m.	33.8	54.2	52.1	46.7
9 p. m.	25.1	36.6	39.6	33.8
Mean	25.6	40.7	41.6	36.0
RELATIVE HUMIDITY.				
7 a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Mean	. .	. .	. .	. .
PRESSURE AS OBSERVED.				
7 a. m.	29.263	29.246	29.062	29.181
2 p. m.	29.163	29.116	29.053	29.107
9 p. m.	29.173	29.127	29.049	29.116
Mean	29.196	29.163	29.055	29.135
MILES PER HOUR OF WIND.				
7 a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Total miles	1550	2967	3141	7658
CLOUDING BY TENTHS.				
7 a. m.	5.6	4.6	5.8	5.3
2 p. m.	6.1	4.9	4.3	5.1
9 p. m.	5.7	1.7	5.1	4.2
RAIN.				
Inches	5.0	0.58	.20	1.28

The last ten days of February were somewhat milder than the second decade, but it remained quite wintry through February, and the mean temperature was only 20°. There have been no days, since February 20th, when the temperature fell below 10°, and since March 1st the lowest temperature was 14°. Very little rain or snow has fallen. The heaviest snowfall of the winter occurred February 23d when about six inches fell. Northerly winds have been prevalent but the total wind travel has been rather below the average at this season.

Altogether the season is backward, and a cold, late spring seems likely to be the sequel to a long severe winter.

ENGINEERING.

THE NICARAGUAN CANAL.

J. W. MILLER.

Just at this time, when attention is directed to the Central American war, perhaps the attitude of the national government may be better understood and its importance to us more fully realized after reading the following relating to the proposed Nicaraguan Canal, written by J. W. Miller, superintendent of the St. Louis, Ft. Scott & Wichita Railroad Company. Mr. Miller was in the naval service, and twice made survey of the Nicaraguan and Panama routes, prior to his journey round the world with Gen. Grant. A man of unusual intelligence and culture, with powers of observation that make his notes of special value at this time, from which liberal extracts are taken:

Few persons seem at all aware how simple an engineering feat the canal problem present ot Nicaragua. The summit level is the lake, only one hundred feet above tide-water. From its southeastern end flows the San Juan River, which can be used for more than sixty miles of its length, leaving only forty-five miles for a canal. This canal runs through a low alluvial land, no excavations are necessary, no tunnels have to be bored, while the last seven miles before reaching the Atlantic is simply ditch work through the swamps and lagoons, where there is already an average of seven feet of water.

To return to the upper part of the San Juan. Sixty miles are to be utilized by damming the stream. This idea has been ridiculed by various engineers on the score that freshets would wash away the dams—a natural though hasty conclusion to be reached by any one conversant with the immense destructive force produced by tropical water rainfalls. But note that at Nicaragua alone freshets do not occur, for the lake is in an immense basin, one hundred miles long by thirty broad, into which the old surrounding country is drained, the river San Juan being simply an outlet, never rising more than six feet during the entire year. Contrast this gradual rise with the "cataract" which would be formed in the Chagres River if the Panama Canal were built. Slack water navigation is, therefore, feasible on the San Juan, and feasible nowhere else upon the Isthmus, for at no other point is there a constant level reservoir. "But," we are told, "the locks will necessarily be of such size that traffic will be suspended through the time taken to fill and discharge them, and ships endangered by the breaking of flood-gates." Mr. Menocal has gotten over these objections in his ingenious method of admitting and discharging the water of the locks. If not, Captain Eads' railway can be used in connection with the canal. None of the short canals around the dams are to be more than two miles long, and marine railways

might prove less expensive and overcome the ten-foot "lift" from lower to upper level with greater ease than a lock.

Next, let us look at the Pacific section. It is a generally received idea that the Cordilleras of the isthmus extend in one unbroken barrier from Mexico to South America. Fortunately, in Nicaragua they trend to the eastward of the lake, ending on its western side in the volcano Monbachio, near Granada. From Granada to Rivas the country is a succession of hills, nowhere rising to an altitude of more than 1,000 feet, and sinking to an elevation of less than 130 feet above the lake at the point where the canal crosses the divide. In other words the "cut" to be made is 127 feet, plus the depth of the canal. The divide is six miles from the lake and about ten from Brito, the Pacific terminus. To lock down this distance is a simple matter; or, again, let Mr. Eads give us a double track railway.

When the expedition sailed for Nicaragua the great problem to be solved was the discovery of a pass through this western section. More than three months were passed in surveying tentative lines, and when two were found with profiles of less than 130 feet, we could scarcely believe our levels were correct. They were gone over again, one of the routes being only seventy-eight feet at its summit.

When the expedition returned to the United States the advocates of other routes, unable to find any fault in the Nicaraguan line, immediately set about to discover imaginary objections. It was bruited abroad that there were no harbors at either terminus. Let us see if this is true.

Graytown is in reality a better harbor than ever. Thirty years ago the San Juan and its tributaries from Costa Rica (which enters below the canal) brought down vast quantities of sand and detritus. The volcanic sand, being of light specific gravity, had the effect of making a shift bar across the mouth of the river. Eventually this bar became so extensive that the stream sought an exit further southward, at Colorado Bay, where it now discharges. There are to-day fourteen feet of water inside of the bar, and outside of it the ocean bed is hard and stable, the coast current having set the whole amount of sand back against the outer shore, which is now covered with trees and bushes. The absence of the silt-bearing river is, therefore, a cause for congratulation; and a channel once dug through Greytown Bar, the harbor is an accomplished and enduring fact. All tropical rivers are a curse to a harbor. There is not the slighest chance that the San Juan will ever return to its original bed, the history of its change of course and the configuration of the land, both going to prove that its tendency is to work south.

It must be granted that there is no good harbor at Brito, the Pacific terminus, but there is an excellent one a few miles to the southward, which would afford ample refuge for incoming vessels. Brito, however, is susceptible of very great improvement at moderate cost; a tall cliff protects the roadstead from northers, and the bottom land of the mouth of Rio Grande (which empties at the base of the cliff) can be easily excavated.

That the Nicaragua route is nearer the United States than others is self-evident, but the gain in distance between the Pacific and Atlantic ports is not the only advantage; for, granted that much of the carrying trade will still be done by sailing vessels, the "doldrum" weather of Panama Bay and its neighborhood will be avoided, and a gain in time of two or three weeks made by ships using the Nicaraguan Canal.

The last reason for advocating the Nicaragua route, "that it presents the advantage of a unique harbor between the two oceans," is in itself a sufficient argument to overcome any minor objections. But Lake Nicaragua is more than a harbor. It is a harbor of purest fresh water; a sheet of water surrounded by land capable of producing every variety of provisions necessary for victualling ships; the plains near the city of Rivas are rich in tropical fruits, and the table-lands produce corn, chocolate and sugar, while the cereals of the temperate zone grow upon the mountain sides of eastern Nicaragua.

On the return of the expedition, much time and labor was given to working up the various journals and levels, and from the figures obtained the exact cost, founded on the price of labor then current, necessary to construct a canal was obtained. To this cost was added the usual 25 per cent for contingencies, and subsequently a still greater amount was added, on the supposition that rock might be encountered two feet below the present profile. The estimates may, therefore, be considered as above rather than below the actual cost, but with all these additions, the Nicaraguan Canal will be $20,000,000 cheaper than any other.—*Kansas City Journal.*

MEDICINE AND HYGIENE.

THE ORIGIN AND SPREAD OF CHOLERA.

B. F. JONES.

I will present an article which appeared in "Bradstreet's," a New York "journal of trade, finance, and public economy," March 21, 1885, upon the subject of water supply in its relation to cholera, which contains as much common sense, it seems to me, as it is possible to get into the space occupied and which will be read with interest by the people of Kansas City. The author is Colonel William Ludlow, chief engineer of the Philadelphia water-works. His reference to the fact that the most common vehicle for the transmission of cholera is drinking-water which has been contaminated with cholera discharges, is a source of comfort so far as such discharges are likely to affect our water-supply. It is a well known fact that there are no sewers above us on the classic stream from which our supply is taken to cause the least apprehension—but this article cannot be of

the least comfort to those who will persist in the use of water from wells and cisterns which are most likely to have seeps from sewers, cess-pools, and the like, in which these deathly cholera discharges have been deposited:

"The important question of water supply is attracting marked attention all over the country, and numerous communities, large and small, hitherto unsatisfactorliy provided for are taking steps to procure charters and raise the necessary funds for new constructions. The rapid growth and practical application of sanitary knowledge of late years has largely contributed to the result, but in especial has the public sense of the importance of a wholesome water supply been quickened and aroused to action by a widespread anticipation of an invasion by Asiatic cholera.

"It is in accordance with all past experience that this plague will reach us in the year following its appearance in western Europe, but whether it comes or not we have had ample warning, and furthermore are in possession of the requisite knowledge of how to meet it and forbid it to do more than effect a landing.

"The cholera is purely a filth disease, which alike in its home amid the ignorance and squalor of Bengal or isolated in hospitals under the surveillance of the most skilled physicians, claims as victims more than 50 per cent of those reached by its insidious attack. But while it thus baffles all medical skill and arouses the bitterest contention among those who seek to explore the mystery of its genesis, the practical methods of dealing with it are well understood and can be rendered entirely effective. The individual victim must take his half chance, but the community can be protected.

"It has been well determined that only in the alimentary canal is the specific poison of cholera capable of its deadly work in man. It is true that infected clothing will transport it, but unless the germ reach its appointed place in the human intestines no harm can result. The healthy stomach even is proof against it, so that whether at home or on its pestilential journeyings experience has proved that the common vehicle of its transmission from victim to victim is drinking-water which has been previously contaminated with cholera discharges.

"The moral of this is evident. The first care of those who bear the responsiblity of protecting the public health is to see to it that the most minute precautions shall be taken to guard the water supply from possible contamination. It is not enough that the time has gone by when a well sunk in earth saturated with sewage or surface drainage can be permitted to spread its contagion. Attention must be given to this, it is true, since the ignorance of people is only supassed by their obstinacy, but the health officer or local official who fails to close a source of such deadly peril to the community should himself be buried alive in it. Cisterns and reservoirs too, must be thoroughly cleansed and purified, drains explored, opened, repaired and ventilated; sewer connections examined and trapped; care taken that the water to be used for dietary purposes has no possible connection with that used for flushing. These details are obvious and need not be enlarged upon.

"But the broader field remains to be explored. I will venture to say that

at the present time there are very few water supplies in the land into which more or less water-closet or similar drainage does not find its way to a greater or less extent.

"The entire region drained by the supply should be gone over as though with a fine-toothed comb, and every spot where human pollution could by direct discharge or indirect filtration reach the drinking-water, should be at once and permanently eradicated. This will in many cases arouse opposition and contumacy, for it is impossible, unless one has actually undertaken the task, to realize the brutal selfishness of those who, unendangered themselves, will claim the right to continue the poisoning of their neighbors. Were they to do so at close quarters a shotgun would be a proper argument, but since their premises are beyond the range of a rifle they will persist in imperiling the lives of others unless the strong hand of the law be laid upon them.

"These considerations, you will observe, apply as well to new sources of supply as to those already existing.

"It would be desirable to supplement this minute exploration of physical features by analytical and microscopic investigations. While chemistry has its limitations and cannot positively assign the causes of certain components of water supply and totally fails to disclose the existence of diseased germs it is extremely useful as a guide, and especially in confirming the results of local examinations. The field of microbiology in connection with water supply is as yet hardly entered upon, but its application can not fail to prove of the very highest value and furnish indications beyond the possibilities of other methods.

"It is needless to say that both chemist and microscopist should be competent to do their work. Nothing is more misleading and worthless than the report of the ignoramus or the charlatan, and the world, even the scientific world, is not at present composed of instructed and conscienscious men exclusively.

"With the general supply thoroughly guarded, no spread of pestilence need be feared. Should individual cases occur they can be strictly localized and contagion exterminated; but while the presence of cholera need occasion no panic, it must be remembered that nothing but unremitting vigilance and thorough preparation can avail to suppress the foul visitor or prevent his swarming and invisible myrimidons from penetrating to our homes and fastening upon their prey."

I think the careful perusal of the above will be a thorough vindication of the senseless idea that our water supply will induce cholera.—*Kansas City Times.*

PREVENTION OF CHOLERA.—THE STATE BOARDS OF HEALTH REPORT.

The report of the committee of the State Boards of Health upon the "Practical Work Required for the Prevention of Cholera in this Country" embodies the recommendations made to the United States and Canadian Governments and to the country at large. The recommendations were drafted by a committee

composed of Henry P. Baker, Secretary of the Michigan Board of Health; H. P. Wolcott, Chairman of the Massachusetts Department; S. S. Herrick, Secretary of the Louisiana Board; Peter H. Bryce, Secretary of the Provincial Board of Ontario; J. H. Rauch, Secretary of the Illinois Board.

There are three essential factors to the prevalence of cholera in this country as an epidemic: (1) The importation of the disease by means of ships more or less directly from its only place of origin in India; (2) local unsanitary conditions favorable to the reception and development of the disease; (2) persons sick with the disease in some of its stages, or things infected by such sick persons, to carry it from place to place. These three factors naturally suggest the methods of combating the disease, for which there is needed practical work, international, national and inter-State, State and local. So far as relates to State and local boards of health, their organization and activities are greater than ever before; but it must be admitted that after cholera has been introduced into a country, inland quarantines are not easily and sucessfully maintained, although efforts in this direction are even then advisable. In view of the threatened introduction of cholera into this country during the coming year, and the consequent immense waste of life and property values through derangements of commerce, trade and productive industries, it is the sense of this conference that the General Government should maintain such a national health service as shall, by rigid inspection at the port of embarkation, question the freedom from disease and infection of all persons and things from infected districts; and shall secure the surveillance of such persons and things while on shipboard, and, when necessary, detention at quarantine stations on this side for treatment and disinfection.

In view of the present threatening aspect of Asiatic cholera, and the constant danger from other communicable diseases occurring at foreign ports having commercial relations with the United States, we urge upon Congress to provide for the appointment and maintenance at all such foreign ports where cholera, yellow fever, plague, small-pox, or scarlet fever exist or are liable to exist, of medical officers of health, the same being either accredited consuls or attached to the consulates. The duties of these officers shall be: To give notice, by telegraph when practicable, of the existence or appearance of any of the above named diseases to some constituted authority in this country; to give notice of the departure of any vessel known or suspected to be infected for any port in the United States; and, whenever requested by the master of any vessel about to load or leave for this country, to inspect thoroughly such vessel in all her parts, and also her cargo, her crew and passengers; to use such cleansing and disinfection as he may deem necessary, and to satisfy himself that all persons about to sail are free from dangerous communicable diseases, are not recently from infected places, and are properly protected from small pox, giving to her commander a certificate of the inspection and of all precautionary measures taken. And it shall be the duty of the central authority in this country to transmit promptly intelligence of the existence of the above-mentioned diseases at foreign ports and places, and of the

departure of dangerous vessels for the United States and Canada, to all State and local health authorities in the country which may be interested in the same.

We further recommend, in case of those foreign ports which have no consular agents in this country, or no telegraphic communication with this country, and which are liable to transmit pestilence through commercial intercourse, that one or more medical officers be chosen to visit such ports as often as may be deemed necessary by the central health authority in this country, so as to give trustworthy information of the health and sanitary condition of those places.

Inasmuch as the Dominion of Canada is equally interested with the United States in protecting itself and the United States from the importation of dangerous diseases, we suggest that Congress take such measures as will bring about concerted action with the Dominion and the British Government by which the consuls of this country or of England at foreign ports shall examine and take such action as they may deem effective, and notify the authorities of such government as has authority over any port to which any ship may sail in the United States or Canada, in order that such government may be in a position to take effective measures against the importation of these diseases. We are gratified that the authorities of the Dominion of Canada and of the Province of Ontario have taken active steps toward protecting the people of Canada and indirectly those of the United States, by the adoption of extensive quarantine regulations. We feel, however, that with respect to those regulations regarding the landing of passengers from the mail steamers along the St. Lawrence, etc., further special regulations for the thorough disinfection of the baggage and effects of all passengers, cabin or steerage, as come from infected ports and places, should be carried out in a manner similar to that recommended by the National Board of Health. Believing that the importation of cholera into this country has usually attended the presence of immigrants from infected countries, we therefore recommend that all such immigrants be prevented from landing at our ports until such time as the danger of the introduction of cholera by them shall have passed.

The inspection and quarantine service inaugurated by the National Board of Health, and set forth in the paper by Dr. Smart before this Conference, but which system is now inoperative for want of an appropriation by Congress, meets with our cordial approval. To enable these protective measures to be carried out, we recommend that Congress be urged in the strongest terms to legislate on this subject at an early date in its coming session, and to appropriate such funds as may be needful. The expenses incident to the work which has to be performed at foreign ports, and the establishment of refuge stations at points on our coast for the detention and treatment of infected vessels arriving from foreign ports, should undoubtedly be borne by the National Government, and not by individual States or municipalities, for the benefits accruing therefrom are general and not restricted to localities, although some ports and cities on the coast may have a more immediate interest in the matter than others in the interior It is probably, however, that this national protective work may not be sufficient.

It will undoubtedly delay and lessen the chances of invasion, but it may not

prevent invasion; the poison of the disease is subtle, and may effect an entrance into the country at some unguarded point. The funds necessary to the stamping out of the disease in a particular locality, and to the prevention of its spread to other localities might in some instances be borne by the municipality or State affected; but should the disease occur in a locality which has failed or is unable to make provision for the occurrence, its spread to other cities and States would be imminent. The want of means at the infected point would be disastrous to many others. Congress has recognized the necessity for aid to State and local boards of health under similar conditions in the case of yellow-fever. In 1879 the sum of $500,000 was appropriated and placed at the disposal of the National Board of Health; and the records show that of this sum $160,000 was employed in combating the epidemic of that year. We therefore recommend that the influence of this Conference be used with the view of having appropriated by the National Legislature the sum of $500,000, to be used, or as much thereof as may be needful, in case of a cholera invasion, in stamping out the disease from the infected localities, and in preventing its spread from state to state.

The removal of local unsanitary conditions favorable to the development of cholera is the especial work of state and local boards of health. Much has been done already in some states, but much remains which should receive immediate attention. Where it can be done, State Sanitary Inspectors should be appointed to visit all the towns and cities specially liable to the disease, to counsel with the local authorities as to the best methods of prevention. This work should be vigorously prosecuted before the disease reaches our shores.

The cause of cholera is contained in the discharges of persons affected by the disease, or in things infected by such discharges. Should the disease reach our shores, the first case, and after this the first case which reaches any given community, should be strictly isolated; all infected material from those and from any subsequent casses shonld be destroyed in such manner as to stamp out the disease. Intelligent sanitary precautions beforehand and scientific disinfection and treatment in the presence of the disease should take the place of necessary cruelties in case of a panic. In case any city or town is infected, the same principles of isolation should in general be applied to the city as to the infected individual. Intercourse with other places and cities should be under sanitary supervision, substantially as set forth in the rules and regulations of the National Board of Health, respecting the inspection of travelers, disinfection of effects, vehicles, etc.

Health officers and inspectors appointed by state or provincial boards of health should, in addition to other sanitary work, see that the localities have set apart, erected, or planned to be set apart or erected, structures which shall possess the sanitary requirements of an isolation hospital. But as regards all necessary work by local boards of health, most state and provincial boards of health have printed and issued documents which give ample instructions.

BOOK NOTICES.

CREATOR AND CREATION: By Laurens P. Hickock, D. D., LL. D. Octavo, pp. 360. Ivison, Blakeman, Taylor & Co., New York. For sale by Ginn, Heath & Co., Boston.

This is an intensely philosophical treatise upon the knowledge in the reason of God and his work, and is an attempt to present the physical portion of a philosophy which shall be able, with the metaphysical portion already presented in rational psychology, to harmonize the observed phenomena of nature and the faith of theists so that both shall be found to be essential parts of a unified spiritual scheme competent to silence all skeptical cavilling at theology. In the words of the author, "After a critical examination of the leading theories of modern philosophy, exposing the main point in which with most there is an utter, and in the best a partial, deficiency, and therein opening the sure process to the knowledge of an absolute Creator, the Creation is itself speculatively contemplated in its essential forces and those determined in their necessary connections."

The argument of the work is that these essential forces have their determined connections in all the mechanism of inorganic nature, and then a life-power is contemplated as superior by the Creator, which uses these essential mechanical forces in spontaneously upbuilding about itself, and for its own ends, the varied organic structures of the vegetable and animal kingdoms; when a contemplated endowment of animal life sentient life with reason introduces man in the image of the Creator and crowns the creative work with a spiritual kingdom in humanity which has dominion over all.

The following is the author's general method: First, to determine the extent of knowledge within experience; to recognize reason as competent to carry our knowledge beyond experience and then, by reason, to attain the sure knowledge of a being who may be an Absolute Creator.

Second, to show that no one space and one time can be determined in common for all, without a knowledge of fixed force in place, and passing force in period, to contemplate how such distinguishable forces may be originated, and by their multiplication and interaction a material universe may be consummated, and then how the superinduction of a life-power may build up all the organisms of the vegetable and animal kingdoms, and the gift of reason may elevate the animal to the human.

The work is divided into two parts, I—Knowledge of a Creator, II—Knowledge of Creation. The first is divided into three chapters entitled: Knowledge Restricted to that which is Gained in Experience; Reason Competent to Know an Outer Creation; Reason Knows the Creator. The second is also divided in three chapters, viz.: Space and Time; Force; Life. Force is considered under three divisions; Antagonistic force; Diremptive force; Revolving force. Under

the head of Life are discussed The Reign of Life in the Vegetable Kingdom; Reign of Sense in the Animal Kingdom; the Reign of Reason in humanity.

It will be seen by this meagre outline of the scope of the work that the execution of the plan necessarily carries the reader to the highest sphere of speculative philosophy, yet he will find that "by the use of reason as a distinct organ of transcendental knowledge we may consistently attempt to attain a knowledge of the Creator; following which we may also consistently seek to know the work of Creation in its incipiency, progress and consummation."

We commend it to all who desire to obtain a view of the subject from a higher standpoint and from a more comprehensive platform than are ordinarily furnished by thinkers of the merely materialistic school.

CHAPTERS ON EVOLUTION: By Andrew Wilson, Ph. D., F. L. S., Etc. With 259 illustrations. Octavo, pp. 383. G. P. Putnam's Sons, N. Y. For sale by M. H. Dickinson; $2.50.

This is not a new work, but it probably presents the facts and arguments of evolution as fully and fairly as any that has been published. Commencing with the almost simultaneous promulgations of the theory, worked out at opposite points on the globe, by Darwin and Wallace in 1858, he states the problem concisely and clearly, following the statement with consequent and logically arranged chapters upon the study of biology, the constitution of the animal and plant kingdoms, protoplasm; the evidence in favor of the theory from rudimentary organs; from the tails, limbs and lungs of animals; the evidence furnished by the science of likenesses; from missing links, from development in the earlier stages in the life history of animals, in the life histories of star fishes and crustaceans, and from the development of mollusks, anphibians, etc.; the evidence for the life-histories of insects; from the constitution of colonial or compound animals; from the fertilization of flowers; from degeneration; and finally a chapter on geology and evolution.

The whole is bountifully illustrated with wood cuts, while the style is attractive and lucid. Any reader who wishes to find the whole subject fully treated in one volume need go no further than this.

THE APPROACHING END OF THE AGE: By H. Grattan Guiness. Sixth edition. Octavo, pp. 776. A. C. Armstrong & Son, New York, 1884. For sale by M. H. Dickinson, $2.50.

The full title of this work is "The Approaching End of the Age, Viewed in the Light of History, Prophecy and Science," and its author, who is Director of the East London Institute for Home and Foreign Missions, has devoted many years of patient and laborious research to its preparation. Its object is to prove that the day of Christ is at hand, or, to use the language of the author, "that the time for evangelizing the nations and gathering in the church of the first-born

is speedily to expire—that the long day of grace to the Gentiles is all but over, and that apostate Christendom, so long spared by the goodness of God, is soon to be cut off by his righteous severity—that the mystery of God is all but finished and his manifested rule about to be inaugurated—that the closing Armageddon conflict is at hand and the complete overthrow of the confederated hosts of evil; that scarcely a single prophecy in the whole Bible, relating to events prior to the second advent of Christ remains unfulfilled."

In elucidating the subject and explaining the fulfillment of scripture-prophecy he has presented an astonishing array of facts regarding the world's history and chronology, the nature and object of prophecy, the plan of providence, the system of times and seasons of nature and the periodicity of vital phenomena. The facts of nature and of revelation are collected and compared, and the author finally claims that all the proofs are of a character that no sober minded Christian, student can reject.

The amount of information on obscure historical points, astronomy and philosophy crowded into this work is wonderful, and the fact that it has, in six years, reached its sixth edition, is strong evidence of its acceptability to a large class of intelligent readers.

THE THEISTIC CONCEPTION OF THE WORLD: By B. F. Cocker, D. D., LL. D. Octavo, pp. 426. Harper Brothers, New York. For sale by M. H. Dickinson. $2.50.

This work, though not exactly new, is still one of the best constructed arguments in opposition to certain materialistic tendences of modern thought to be found, and is decidedly worthy of the careful study of all who are interested in the question of the personality and providence of God. Professor Cocker is the author of a treatise upon "Christianity and Greek Philosophy," published several years ago which attracted much attention among earnest Christian thinkers, at least. The present essay is devoted to an effort to show that the theistic postulate is not degraded to a mere hypothesis, inadequate to explain the Universe, but that man must still continue to look up to a personal God and to that providence which is pre-eminently revealed in history, "instituting a Kingdom of God upon earth by a supernatural guidance and grace."

The author has constantly in mind the issue made by Strauss in his "The Old Faith and the New," as between God and no God—between the belief in a personal God and the impersonal All, which justifies him as he says, in his attempt to restate and defend the "Theistic conception of the world."

The scope and logical sequence of the work can be judged of from the following titles of the eleven chapters comprised in the book: The Problem Stated; God the Creator; The Creation; Creation—the Genesis or Beginning; Creation: its History; Conservation—the Relation of God to the World; Providence of God in Human History; The Relation of God to Humanity; Special Providence and Prayer; Moral Government—its Grounds, the Correlation between God and Men; Moral Government—its Nature, Condition, Method and End.

The author claims that the signs of the times are propitious, that at present the conflict between reason and faith, science and religion, presents many hopeful indications of an approaching conciliation and that the most candid men on all sides of the question are "hourly catching glimpses of the everlasting harmony which pervades the universe of being and thought."

It is a book that presents the whole subject fairly, thoughtfully and, as we regard it, with powerful force in favor of theism.

WONDERS AND CURIOSITIES OF THE RAILWAY: By Wm. Sloan Kennedy. 12 mo., pp. 254. Second edition. S. C. Griggs & Co., Chicago. For sale by M. H. Dickinson, $1.25.

This handsome and admirably illustrated book contains a condensed history of railroad building and progress all over the world and is a most interesting volume to the general reader, as well as to the railroad man. Commencing with "Beginning in Europe," we are next instructed as to the first American railroads; then as to the "Banding of the Continent," "The Locomotive in Slippers," "A Mosaic of Travel," "A Handful of Curiosities," in railways and locomotives; an account of mountain railways, vertical railways, tramways; the uses and functions of railways in war, the luxuries of travel as shown in the private cars of Vanderbilt and others; descriptions of old and new styles of rails, trains, etc. There are more than twenty illustrations of ancient and modern railroad cars, engines and other improvements.

Taken altogether this book is a success and will have a heavy run if "found out" by the public.

MEDICAL ELECTRICITY: By William White, M. D. 12mo., pp. 203 Fowler & Wells, New York. For sale by M. H. Dickinson, $2.00.

This is a manual for students, intended to show the most scientific and rational application of electricity to all forms of acute and chronic disease by the different combinations of electricity, galvanism, electro-magnetism, magneto-electricity and human magnetism. Dr. White is professor in the New York Medical College for women, and brings to the subject a large experience in the treatment of all classes of diseases and, while he does not discard drugs altogether, he believes that electricity can be made to take their place in many instances. His style is good and his directions for the application of this remedial agent clear and precise, so that no one need make any mistake in its use.

TECHNICAL EDUCATION, AND OTHER ESSAYS: By Prof. T. H. Huxley. Price, post free, 15 cents in postage stamps. J. Fitzgerald, Publisher, 20 Lafayette Place, New York.

This latest number of the "Library of Science" is one of the most valuable and interesting in that popular series. Besides the essay on "Technical Educa-

tion," which by itself is worth more than the price of the whole number, there are four other essays, namely, on Joseph Priestley, the discoverer of oxygen; on the Connection of the Biological Sciences with Medicine; on Sensation and the Sensiferous organs; and on Certain Errors respecting the Structure of the Heart attributed to Aristotle.

OTHER PUBLICATIONS RECEIVED.

Cassell's Family Magazine, American Edition, Vol. I, Nos, 9 and 10, November and December; $1.50 a year, 15 cents monthly; Cassell & Co., New York. *The Virginia*, a Mining, Industrial, and Scientific Journal, Jed. Hotchkiss Editor and Proprietor January, 1885; $2.00 a year 25 cents a month, Staunton, Va. Iowa State Historical Record, published by State Historical Society, at Iowa City, Iowa; January, 1885. National Water Works Co., Kansas City, Mo., revised water rates and rules and regulations for 1885, B. F. Jones, Superintendent, Kansas City, Mo. *Humboldt Library*, No. 66: Technical Education and other essays, by Thomas H. Huxley; price 15 cents; J. Fitzgerald, Publisher, New York. Johns Hopkins University Studies, Herbert B. Adams, Editor. Third Series, II–III: Local Institutions of Virginia, by Edward Ingle, A. B.; February and March, 1885, Baltimore, Md. *The University Review*, successor to *Kansas Review and University Courier*, March, 1885. Signal Service Notes, Nos. VI, VII, VIII, IX: No. VI—A Report on Wind Velocities at Lake Crab and at Chicago, by H. A. Hazen; No. VII—The Study of Meteorology in Higher Schools of Germany, Switzerland, and Austria, by Frank Waldo; No. VIII—Variation of Rainfall West of the Mississippi, by H. A. Hazen; No. IX—The Elements of the Heliograph, by Frederick K. Ward, Washington City Signal Office, 1883. A Correlation Theory of Color Perception, by Charles A. Oliver, A. M., M. D., January, 1885, Philadelphia, Pa. *Pacific Science Monthly*, Stephen Bowers, Ph.D., Editor, Vol. I, No. 1, March, 1885, Bowers & Son, San Buenaventura, Cal. Advance Sheets, Report of Experiments, by Prof. E. M. Shelton, Manhattan, Kansas, March, 1885; Experiments of 1884. *New York Medical Abstract*, February, 1885, Vol. V, No. 2; $1.00 per year; Medical Abstract Co., New York. *Bulletin of Washburn College Laboratory of Natural History*, Edited by Francis W. Cragin, Vol. I, No. 2, price 20 cents, Topeka, Kas., January, 1885. Report of Adjutant-General of Missouri for 1883–4, Jefferson City, Mo. Meteorology of Oakland, Cal. for 1882–3, and 1883–4, by J. B. Trembly, M. D., Oakland, Cal. The Revolution of 1884, J. G. Pangborn, Chicago, Ill., 1885. International Electrical Exhibition, 1884. Report of Examiners on Applications of Electricity to Warfare; Fire and Burglar Alarms and Annunciators; Underground Conduits; Electro Dental Apparatus; Electric Telegraphs, published in Philadelphia, Pa. General Truths in Applied Entomology, by Chas. V. Riley, U. S. Entomologist, Macon, Ga., 1884. Report of the Entomologist Chas. V. Riley, M. A., for year 1884; January 31, 1885, Government Printing Office. Department of Agricul-

ture, Catalogue of Exhibit of Economic Entomology at the World's Industrial and Cotton Centennial Exposition, New Orleans, 1884–5; Government Printing Office, 1884. Bulletins of the California Academy of Sciences, Nos. 2 and 3, January and February, 1885.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

SYSTEM OF AERIAL CONDUITS FOR ELECTRICAL WIRES.—Mr. D. B. Macquarrie, manager of the Missouri and Kansas Telephone Company of this city, is the projector of this improvement, his object being to provide for the construction and maintenance of such a system as will overcome the defects of both underground conduits and the present unsightly pole system—one which shall combine all of the efficiency and simplicity possessed by the one with the desirable compactness of the other.

The invention consists principally in supporting upon posts, or columns designed expressly for the purpose, a continuous chamber in which the wires are confined, substantially as hereafter more fully explained.

In construction a line of supporting posts is provided with suitable flanges at their bases and secured to a foundation of masonry. These posts may be of any suitable material and they may be tamped in the ground as ordinary posts are, but preferably, they are formed of cast-iron with a flange at each end.

The flange at the upper end projects sufficiently at either side of the conduit to form a support for the cover-sections when removed from their normal position. This arrangement obviates the necessity of lowering the cover to the ground when the wires are to be repaired.

In constructing the said conduit, sheet-metal is given the preference as to material. The chamber or conduit is rectangular in cross section and is composed of a pair of side-sheets to the lower edge of which a flanged bottom sheet is securely riveted. Bracing-plates, perforated for the passage of the wires, are placed immediately over each supporting-post, they are used mainly to impart rigidity to the sides of the conduit and being provided with flanges they are securely riveted thereto.

The said plates being perforated, they are, of course, utilized as wire-supports, but as they are limited in number, intermediate devices for supporting the wires may be employed. Any of the improved devices now in use for the purpose can be used here.

The wires within the conduit are protected by removable weather-proof cover-sections having pendant side-flanges and tongued and grooved end-portions.

The length of each cover-section should correspond to the distance between the centers of the supporting-columns.

After the wires have been placed in position, any desired section of the conducting chamber or the entire length thereof may be filled with paraffine, or other insulating compound, but this is not essential to the perfect working of the line.

It is evident from this construction that telegraph and similar wires may be confined in a very limited space—for instance: a ten-inch conduit will accommodate two hundred wires, and their electrical condition and freedom from mutual interruption will perhaps be more nearly perfect than those of any known system.

The described system affords absolute protection to life and property, for, unlike the pole system, it will be impossible for a wire to break and fall from its position in the conduit.

The system will operate equally as well when constructed along the narrowest alley-way as upon the broadest streets—a fact of no small importance in the construction and maintenance of a telegraph system.

IMPROVED FOLDING TABLE.—This invention consists, primarily, in constructing the top of the table in two similar sections that are hinged together; the object being to produce a table that may be folded to the form of a small packing-box.

The construction may be described as follows: A pair of top-sections provided with raised border-strips which encircle the edge of each, hinges located upon such strips for connecting the top-sections, a pair of rectangular supporting-frames hinged to fold inward longitudinally upon the under surface of the top, (their cross-bars resting in notches formed in the adjacent border-strips connecting the top sections) and being severed upon a central line and provided thereat with hinges to allow of a transverse fold in closing the top sections together, bifurcations in the lower extremities of the frames, and braces hinged to the under surface of the top for engaging the bifurcations when the table is in use.

The inventor is Mr. J. C. Mehaffey, of Kansas City.

THE ST. LOUIS ACADEMY OF SCIENCE.

In the meeting of the Academy of Science last week Prof. Pritchett gave a description of his work in assisting in the compilation of the topographical map of Missouri. His connection with the work was only as an astronomer, and the Washington University Observatory was held throughout as the basis for all the work. The uncompleted state of the work prompted a suggestion that an attempt be made to obtain an appropriation from the State for its completion. The value of such a showing as might be made of the mineral and agricultural resources of the State, it was thought, ought to induce the making of the appropriation.

Prof. Potter presented some analyses of water made to determine to what extent sewage introduced into the rivers is oxidized and gotten rid of by oxida-

tion. He said opinions of scientists as expressed on this subject did not agree, and quoted some differences. His view was that sewage was oxidized, and to gain evidence on the point he collected specimens of the water to be found in the Mississippi at Bissell's Point, foot of Lesperance Street, off the docks at Carondelet, at the Quarantine station and at Crystal City. The analyses showed that the purest water was found at Quarantine, which is two miles below the foot of Lesperance Street, where the worst water was obtained, and where the main sewers empty their contents into the stream. The water at Crystal City was next to the Quarantine in purity, while the water at Bissell's Point, from whence the city's supply is drawn, was third in purity, and Carondelet fourth. He found in this ample proof that sewage was oxidized and the water purified by running freely in a stream, as also an argument in favor of the establishment of the base of water supply for the city at the Chain of Rocks, above the present point, which is below a drainage district of the city.

The next publication will be a memorial to the late Dr. Englemann. Prof. Asa Gray will be here in April or May, and will be entertained by the Academy. Dr. George Richter was admitted to membership. At the next meeting Prof. Nipher will discourse on some electrical experiments.

A STUDY OF AMERICAN WHEATS.

A chemical investigation of the wheats of the country has been going on for two years in the laboratory of the Department of Agriculture. Such results have been obtained that Mr. Clifford Richardson, the chemist, feels justified in giving publicity to them. From very elaborate tables showing the analysis of a great variety of wheats from all parts of the country these deductions are made. The main failing of American wheats is their deficiency in albuminoids. The highest percentage of albuminoids found by Prof. Richardson was 17.15 in a Minnesota wheat. Russian wheats have been shown to contain 29.56 per cent. The albuminoids are regarded as the most valuable part of the grain. Prof. Richardson says it is difficult to explain for what reason American wheats contain so much less water than is given in the foreign averages, but he has never seen a sample which contained as much as the average given by the chemist Wolf for German wheat. He concludes that the hotter and drier summers of America may afford the explanation. A comparison of the samples analyzed shows that the wheat of the eastern States is the poorest raised, falling below the average in albuminoids, in ash and in size. The improvement is gradual and regular until the Pacific slope is reached, where there is a decided falling off in quality. The best wheat grows between the Mississippi and the mountains. It has a higher average in oil, albuminoids and ash. The Oregon and California wheats, although showing large and handsome grains, contain a comparatively low amount of albuminoids.

After crossing the Mississippi the averages show that in Missouri and Kansas

wheats are deficient in nitrogen, while Texas produces a grain rich in nitrogen, but injured by too small weight per 100. Minnesota has a much larger grain, not quite so well supplied with nitrogen. It is Colorado which leads in the production of a large grain containing a large amount of albuminoids. That State, Prof. Richardson says, shows what the possibilities are of raising a perfect wheat.

EXPLORING ALASKA.

The country seems to have settled down into a conviction of the unwisdom of wasting money, anxiety, health and life upon arctic research. Even Melville's specious proposition to journey to the pole by the comparatively safe way of Franz Joseph Land has met no encouragement either from public prints or private capitalists, and the young yachting swells of New York, who in the roseate warmth of after dinner enthusiasm last autumn were promising their fathers' millions to send the daring engineer north again, are now discreetly silent. It will be some years, probably, before the Government will send men into the icy regions merely to extend geographical knowledge, and it may be that the dreadful results of the Greely expedition, though its purpose was a better one, will put a stop to the national encouragement of this sort of adventure forever. The Government is, however, encouraging explorations in our own territory, in regions not difficult of access, of great geographical and commercial interest, and yet comparatively unknown.

Four expeditions have been sent to Alaska within two years, and have succeeded in giving us a knowledge of the magnitude and possibilities of that once despised possession which is inspiring lofty dreams of national and private wealth. Its fisheries have returned the Government an interest of nearly five per cent a year on the $7,200,000 which Secretary Seward paid Russia for Alaska in 1867, as a delicate acknowledgment of our gratitude for that nation's firm friendship during the rebellion, and now it is found that the possession which we then did not especially want contains vast rivers, mountains, forests and mines of undreamed of riches. Private companies are contemplating the exploration of the country; there are rumors that they are already being carried on in secret and for dishonest purposes; while a fifth Government expedition is nearly ready to sail from San Francisco under the command of Lieut. George M. Stoney.

This young officer has already headed two expeditions to Alaska. He was one of the Rodgers party, who after the burning of that steamer were greatly aided in their retreat southward by the Tschoutche Indians of Alaska. The Government sent him back in 1883 with presents for these Indians, and while with them he heard of a great river that emptied itself into Hotham Inlet, south of the Yukon. With two men and a dingey and ten days' provisions he explored it fifty miles, and found it could be navigated by large steamers for that distance. Last year he explored the river—named Putnam River, in honor of the young officer of the Rodgers who was lost on the ice near Siberia—for nearly 400 miles

and the present expedition is to continue the work. The river, he thinks, will rank among the great rivers of the world; numerous streams flow into it, and it is surrounded by dense forests of spruce and pine and birch, and by a general richness of vegetation unlooked for in so high a latitude.

The Putnam is not so great a river, however, as the Yukon, which Lieut. Schwatka explored in 1883 for 1,800 miles. He crossed the country 150 miles from Sitka in May, to the headwaters of the Yukon, where he built a raft, and floated down the stream, through marshes, deep lakes and great cañons, where the water sometimes rushed for five miles between huge basaltic cliffs. The Yukon "is so long," says Lieut. Schwatka, "that if its source were at Salt Lake, its waters might empty into New York Bay, and its mouth is so wide that New York would be on one side and Philadelphia on the other." Another expedition, under Lieut. Abercrombie, attempted last summer to explore the Copper River, which is from 400 to 500 miles long, but did not penetrate it far.

Of the wisdom and utility of these explorations there can be no question. Alaska is not ice-bound the year through; steamers can get to Point Barrow, the northernmost land, at almost any time, and sailing vessels can reach it in ordinary summer weather. We know the country almost for its fisheries alone; its immense and almost inexhaustible tracts of timber are scarcely touched, and its mineral wealth is almost a matter of speculation. The research should be exhaustive and more distinctly scientific than it has been; and it is pre eminently a Government work.—*Globe-Democrat.*

COAL-DUST IN COLLIERY EXPLOSIONS.

Bergrath Althaus, in a recent session of the Natural History Division of the Silesian Society *für vaterlandische Cultur*, made an interesting report concerning the work of the Prussian Commission for the discovery of safeguards against fire-damp, in the course of which he called special attention to the effect of coal-dust in aggravating the disastrous effects of explosions. Of the fatal accidents in Prussian coal-mines, $\frac{1}{11}$ are due to fire-damp; and the average number of deaths per explosion *where coal-dust is present* is 5, against 1.4 where coal dust is absent. This statistical argument is conclusive as to the importance of a study of the part played by coal-dust in such cases. The paper of Mr. Hutchinson, published in the Engineering and Mining Journal, January 10th, 1885, sums up the English investigations of this subject, almost to the present time (we believe one or two important papers have appeared since it was written); but it is less full and satisfactory as to what has been done in Europe; and it leaves in doubt the vital questions involved.

Bergrath Althaus, in the report to which we have referred, says of the English investigations, particularly of Galloway and Abel, that "they did not succeed in completely explaining the influence of coal-dust; and hence opinions on the subject continue to differ." But he remarks, a little farther on, that the

expensive experiments conducted since the middle of 1884, at the König mine, at Neunkirchen, near Saarbrücken, have completely solved the problem, have set all doubts at rest. He says: "We can now distinguish dangerous from harmless coal-dust. We know where we must forbid the use of fiery explosions altogether, and substitute other means."

The report of the experiments at the König mine, we shall discuss in a later issue. Professor Hasslacher, of Berlin, who acted as reporter of the Prussian Commission, has made some general statements concerning them, from which it appears that all kinds of coal-dust are capable of exploding violently when ignited by such means as the electric spark, and that the extent of the explosion is much greater with coal-dust than with fire-damp. These conclusions contradict those of the earlier French Commission, which thus appears, on insufficient evidence, to have underrated the danger from this source. The Prussian experiments go to show that dust without the recognizable presence of fire-damp may become, under some conditions, a destructive agent. A thorough study of the experiments themselves will be required, in order to see how far they explain the most impressive fact of all, namely, the fact that so many dusty coal-mines and coal-breakers never have any explosions. No theory which does not somehow account for this fact can be considered complete.

Concerning the quantity of fire-damp generated in Prussian mines, Mr. Althaus observes that 9,000,000 cubic meters escape annually from the shafts of the very fiery Neu-Iserlohn I. mine; and that the seven most dangerous Westphalian mines produce annually 39,000,000 cubic meters. He adds that all the cities of Prussia could be lighted with the gas escaping from Prussian coal mines.

The Pieler alcohol lamp and the Wolf benzine lamp are praised as the most sensitive indicators of the pressure of fire-damp; the former showing so small a proportion in the mine atmosphere as 0.25 per cent, and the latter 2 per cent. Since explosive mixtures contain more than 6 per cent, the warning thus given would in most cases leave ample time for preventing the danger by increased supply of air, the only radical and effective safeguard.—*Engineering and Mining Journal.*

THE PERMANENCY OF WROUGHT-IRON STRUCTURES.

The following by Prof. Rossiter W. Raymond, shows that the views advanced in another article in the present number upon "The Fatigue of Metals," are not unanimously accepted by engineers and physicists :—[*Ed. Review.*]

An elaborate report By Professor Thurston on the present condition of the iron composing the structures of the New York elevated railroads, conclusively shows that these structures have not been overstrained; that they are made of good material, and as good now as it was the day it was put in place; that they are well-proportioned and of a strength far beyond the danger limit for any one of the possible causes of deterioration; that they are not subject to risk of crystalization or of any other source of injury to quality and strength known to

engineers. Professor Thurston's thorough discussion will perhaps, for a time at least, silence the prating of newspaper engineers about "vibration," "crystallization," "decay," and what not.

We cannot forbear to quote a few sentences:

"So far as I am aware, and so far as I can ascertain, there is no evidence extant, and nothing to give the slightest foundation to the belief, that good wrought-iron, loaded within the elastic limit, will ever yield either to stationary or to intermittent unreversed loads, or that crystallization can ever take place under such conditions.

"Thus, that distinguished engineer, the late Mr John A. Roebling, reporting upon the condition of the great Niagara suspension bridge several years after its construction, states: 'After a thorough examination, I am unable to report any change.' Experiment exhibited the same deflection as when the bridge was first built, and no evidence of loss of strength or stiffness was detected by his repeated measurements of the bridge under load. The same engineer, removing the old aqueduct over the Alleghany river, at Pittsburg, after forty years of continuous service, found the iron suspension-rods to be quite equal in quality to new iron. It was used again in a new structure. Tie-bars that had been in service underground, imbedded in clay for twenty-five years, were found in equally good condition as to quality of the metal. The old St. Clair Street bridge, near the same locality, after forty years of service, was taken down to make place for the later suspension bridge at Pittsburg, and its iron was unchanged in quality. Iron originally crystalline remained so; the iron found fibrous at its removal was fibrous when first used; no change in either direction had taken place.

"Testing iron wires from the old Fairmount suspension bridge, taken down a few years since to make room for the new and stronger truss-bridge at Philadelphia, over the Schuylkill, and comparing it with good merchant qualities of wire of the same gauge, I found the two lots of wire substantially the same in quality. Thirty years of work had not apparently affected the wire of the bridge in the least."

It is a serious question, and one which time only can completely answer, whether steel structures will prove as uniformly and permanently reliable as wrought-iron has proved to be, or in other words, whether the fibrous texture of wrought-iron can be equaled in this respect by the granular texture of steel or of ingot iron. In this connection, it is interesting to note that the fibrous texture referred to is imparted to wrought-iron by the presence in it of a small proportion of slag from the puddling-furnace; and that this can be secured in the Bessemer converter also, if desired. The so-called *Kleinbessemerei*, carried on at Avesta, in Sweden, for several years past, produces exclusively soft, fibrous iron by the simple device of pouring slag and iron together into the ingot-mould. This requires however, a very small charge (usually not more than half a ton), and a direct pouring from the converter, without the intervention of a ladle, which would chill the slag.

SANITATION IN ST. LOUIS.

Under the auspices of Alplin Council, Legion of Honor, the first of a series of lectures on sanitation was given at the Pickwick before a large audience by Mr. Robert Moore. The lecture was not burdened with either diagram or charts, but Mr. Moore dealt with the question of drainage in a manner that could not fail to be understood by every one present.

At the outset he remarked on the advance of medical and social science during the last hundred years, and said if man could not add to his stature, he had, by taking thought, added to the number of his days. The chief factor in these beneficial changes was the increase and wide dissemination of the knowledge of the laws upon which life depended. Another factor had been the deepening of the idea of the interdependence and kinship of mankind. From pure selfishness, or from no higher motive, men are now forced to become their brothers' keepers. Another cause was the enormous increase of wealth which the inventions of the last hundred years had brought to men. People were now better fed, better clothed and better housed than their grandfathers were, and consequently enjoyed better health than their grandparents.

The essential conditions to health in large towns were pure air, pure water and pure soil, and the securing of these conditions was the all-important task of the sanitary engineer, and the great test of success in all city governments. The great factors in securing these conditions were the water supply and the sewerage system of a city. Whatever system was adopted—the system of separate sewers for the storm water and the waste water from the dwellings, or the combined system—the general principles were the same. It was necessary that the sewers should be self-cleansing, and that there should be a good outfall from which the sewerage should be promptly and completely carried away. In many places the latter condition was the chief difficulty of all.

St. Louis was particnlarly fortunate in these two respects. Its sewage was carried away by one of the greatest rivers of the world, while Chicago was at the present time seriously considering how to keep its sewage out of its drinking water. Dealing next with the drainage of houses, the lecturer said it was most important that the surplus water should be discharged as soon as possible into the sewer, and that no noxious gas should be allowed to find its way back into the house. House drains should be self-cleansing, and to that end it was important that the pipes should be no larger than was actually necessary, and above all, that they should not leak. Inside the house there should be no plumbing fixtures which were not in daily use.

In conclusion, the lecturer emphasized the fact that owing to the improved sanitary condition of St. Louis about 5,800 lives were saved every year. He showed that St. Louis was naturally a healthy city, and urged that what was needed, in view of the threatened cholera epidemic, was the closing of the eight thousand or more wells and the thirty thousand cesspools in the city. Their continuance was a disgrace to St. Louis, and it should be the duty of every citizen to see that they were closed.

EDITORIAL NOTES.

THIS is the last number of the eighth volume of the REVIEW, and we do not hesitate to call attention to the improvement made in the magazine since its commencing in 1877. Few persons expected it to live so long, and it has been a surprise to its editor and publisher that it has done so, considering the very little time that he has been able to give to working up either subscribers or advertising patronage. Despite this it has attained a standing among the periodicals of the day that is a source of pride and pleasure to him. At the same time it would be an additional gratification if its circulation would be so extended as to make the REVIEW fully self-sustaining. A hundred more subscribers would place it in such a position, while every one beyond that number would help to enable the publisher to increase its attractions by means of illustrations, better paper, etc.

It seems to us that it would be no great burden for each subscriber and friend to obtain one more, and thus make the REVIEW, which is acknowledged by all to be a credit to Kansas City and the West, an undoubted success.

MRS. FLORA ELLICE STEVENS, of Bloomfield, N. M., writes that she has an Aztec skeleton which was excavated from the Aztec ruins, fifteen miles from that place, which can be had by any scientific association or museum for a nominal price. This is a good opportunity to secure a valuable curiosity.

AS ILLUSTRATING the magnitude of the zinc and lead interests of Southeastern Kansas, it may be said that the shipments of zinc ore from Galena, Kas., during 1884 was 32,987 tons, which brought an average of $15 per ton. There were also 10,341,087 pounds of lead produced, worth $20 per ton.

DURING the last month our three medical colleges held their commencement exercises and graduated about forty young doctors. At the Medical Department of the University of Kansas City, Dr. E. R. Lewis, of this city, and President E. R. Hendricks, of Fayette, delivered the principal addresses, Rev. N. Scarritt, D. D., conferring the degrees. At the Hospital Medical College Dr. S. D. Bowker delivered the main address, while Dr. Thorne conferred the degrees. At the Kansas City Medical College J. V. C. Karnes delivered an admirable address, Dr. J. H. Thompson gave the advisory lecture to the graduates, and Dr. E W. Schauffler conferred the degrees and prizes.

THE Illinois State Laboratory of Natural History has been transferred from Normal to Champaign.

CORRECTION.—In the article in the March issue by Professor Cragin, of Topeka, upon "The Tertiary in Harper County, Kansas," the error was made, in the sentence refering to the metacarpal splints of the horse, of speaking of them as "*extremely unusual*," whereas it should have read "*extremely unequal.*" As the error is both awkward and concerns the only part of the article that he considered important enough to emphasize, we hasten to make this correction as public as possible.

LOCALLY the eclipse of the 16th ult. was a disappointment to the astronomers, who had made considerable preparations for observing it, owing to the cloudy weather which prevailed during the whole day. The reports from nearly all points in the West correspond with this, and even in the East it was not much better. The observers at the Naval Observatory at Washington succeeded in taking a number of satisfactory observations and photographs, but not as many as was expected and hoped.

Two important enterprises for Kansas City were practically put in operation here in March, viz: the completion of the cable railway line across the city, and the triumphant realization of the hopes of the proprietors of the Henry Electric Railway. Both of these enterprises are the result of practical scientific and engineering skill of Kansas City engineers, i. e., of Mr. Robert Gillham and Mr. John C. Henry, respectively, backed up by home capital.

We have received from Mr. Charles E. Putnam, President of the Davenport (Iowa) Academy of Natural Sciences, a forty-paged pamphlet, written by him in vindication of the Academy, upon the authenticity of the "Elephant Pipes and Inscribed Tablets," in its museum, against the criticisms of H. W. Henshaw, ornithologist of the Bureau of Ethnology at Washington, D. C., published and endorsed by Major J. W. Powell, director, in his Second Annual Report.

We have not time at this last moment before going to press to examine this pamphlet, but will do so before the next issue of the Reniew.

A vessel was moored at Salem, Mass., the other day, with several cases of cholera on board. This is a warning for every maritime city in the country to be watchful and clean up, and the last adjuration to clean up, is just as applicable to Kansas City as to any other city in the country.

We may add to the above that when the cholera does reach our cities, as it probably will, in spite of all the "cleaning up" that can be done in advance, the principal safeguard to the people is to prevent the spread of the peculiar cholera germ itself (different from all other filth) by such sanitary appliances as are utterly destructive of it. Nothing else will effectually prevent its spread when once introduced into a city.

We find the following in the *Kansas City Daily Presse*: "Number 10 of the eighth volume of the Kansas City Review of Science and Industry has appeared and is excellent in its carefully selected and original abundant reading matter. This number contains e. g. scientific treatises on the Kansas City cable road, on modern and ancient mechanics and architecture, essays in the domain of geology, astronomy, meteorology; correspondence on the World's Exposition at New Orleans, etc. The editor of the journal—that has many renowned savants for its co-workers—is Mr. Theo. S. Case, postmaster of our city.

ITEMS FROM PERIODICALS.

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The *Atlantic Monthly* for April is a remarkably good number. Its serials by Craddock, Mrs. Oliphant, and Miss Jewett progress admirably, and Dr. Holmes adds the attraction of a poem called The Old Song to his installment of The New Portfolio. The papers on Madame Mohl are also continued, and an essay on Time in Shakespeare's Plays, by Henry A. Clapp, forms a pendant to a former article on Time in Shakespeare's Comedies. A delightful paper entitled George Frederick Handle: 1685–1885, by John S. Dwight; Political Economy and the Civil War, a study by J. Lawrence Laughlin; a story called Fate Dominant, by F. R. Stockton; An Unclassified Philosopher, a sketch; and a paper on the sparrow, by Olive Thorne Miller, are the other attractions of the number. The poetry comprises Fiammetta, by Helen Gray Cone; Cressid, by Nora Perry; The Strange Guest, by Edith M. Thomas; and Easter Lilies, by John B. Tabb. There are also reviews of recent poetry by Browning, Tennyson, and Swineburne, and of Gosse's edition of Gray's Works, together with the usual Contributors' Club and Books

of the Month. Houghton, Mifflin & Co., Boston.

With all her other troubles—in Egypt, and Ireland, and Asia—old England has also been passing through a serious agricultural crisis, in which the ancient proverbial expression, "as good as wheat," lost its force, for the price of that commodity touched the lowest point it has reached in the life of this generation. What brought on the crisis, what were its effects, and what remedies have been proposed, are questions that concern the American almost as much as the Englishman, whether he be a producer or consumer of wheat; and they are very ably and clearly discussed in an article by William E. Bear, editor of the *Mark Lane Express*, in the *North American Review* for April. In the same number Charles Dudley Warner presents an interesting Study of Prison Management, while Robert Buchanan, the English poet, discusses Free Thought in America; T. V. Powderly, The Army of the Discontented; and Prof. Hunt, How to Reform English Spelling. The other articles are: The Law's Delay, by Chief-Justice Thomas F. Hargis; and Characteristics of Persian Poetry, by A. R. Spofford. But what will probably attract the most immediate attention in this number is the new department of Comments, consisting of brief criticisms of articles that have appeared in the *Review*. Murat Halstead's political article in the March number is here discussed by three writers—a Democrat, a straight Republican, and an Independent Republican. Richard H. Stoddard comments with a good deal of feeling on Max Müller's Buddhist Charity, and other correspondents take this pleasant opportunity to offer a single thought where an extended article would, perhaps, find neither room nor readers.

Popular Science Monthly, conducted by E. L. and W. J. Youmans, and published by D. Appleton & Co., New York, presents the following attractive table contents for April: "The Character and Discipline of Political Economy," by J. Laurence Laughlin, Ph. D.; "The Nervous System and Consciousness, I.," by W. R. Benedict, (illustrated); "Cholera, III., Propagation, by Dr. Max von Pettenkofer; "A Chapter in Fire Insurance," by George Iles; "Cumberland Sound and its Eskimos," by Dr. Franz Boas; "Religious Value of the Unknowable," by Count D'Alviella; "Liquor Legislation," by Gorham D. Williams; "Aristotle as a Zoologist," by Frederick A. Fernald "Apiculture," by Allen Pringle; "Structure and Division of the Organic Cell," by Chas. Morris; "The Chemistry of Cookery," by W. Mattieu Williams; "Internal Arrangement of Town-Houses," by R. W. Edis, F. S. A.; Sketch of Prof. John Trowbridge, (with portrait); Correspondence; Editor's Table; Literary Notices; Popular Miscellany; Notes.

An informing and timely article on the "Framers of the Constitution," with twenty or more portraits, is the opening gem of the beautiful *Magazine of American History* for April. It is the first instance in the historic literature of America, of the successful grouping of the whole fifty-five of these remarkable men, in one vivid pen-picture. The editor has performed a service that will be gratefully appreciated by hosts of students and writers, and by readers of all grades and ages the country through. The exact data given will prove a great help to teachers; and it should be made as familiar to every American child as the multiplication table. The other articles of the number are of exceptional merit, including as usual a wide range of topics. Price, $5.00 a year in advance. Published at 30 Lafayette Place, New York City.

Mind in Nature is the title of a new popular journal of psyhical, medical and scientific information, published at Chicago by the Cosmic Publishing Company, under the management of J. E. Woodhead, at 171 West Washington street. Monthly; $1.00 per annum.

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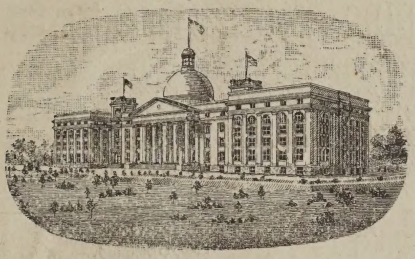
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